

MIT LIBRARIES

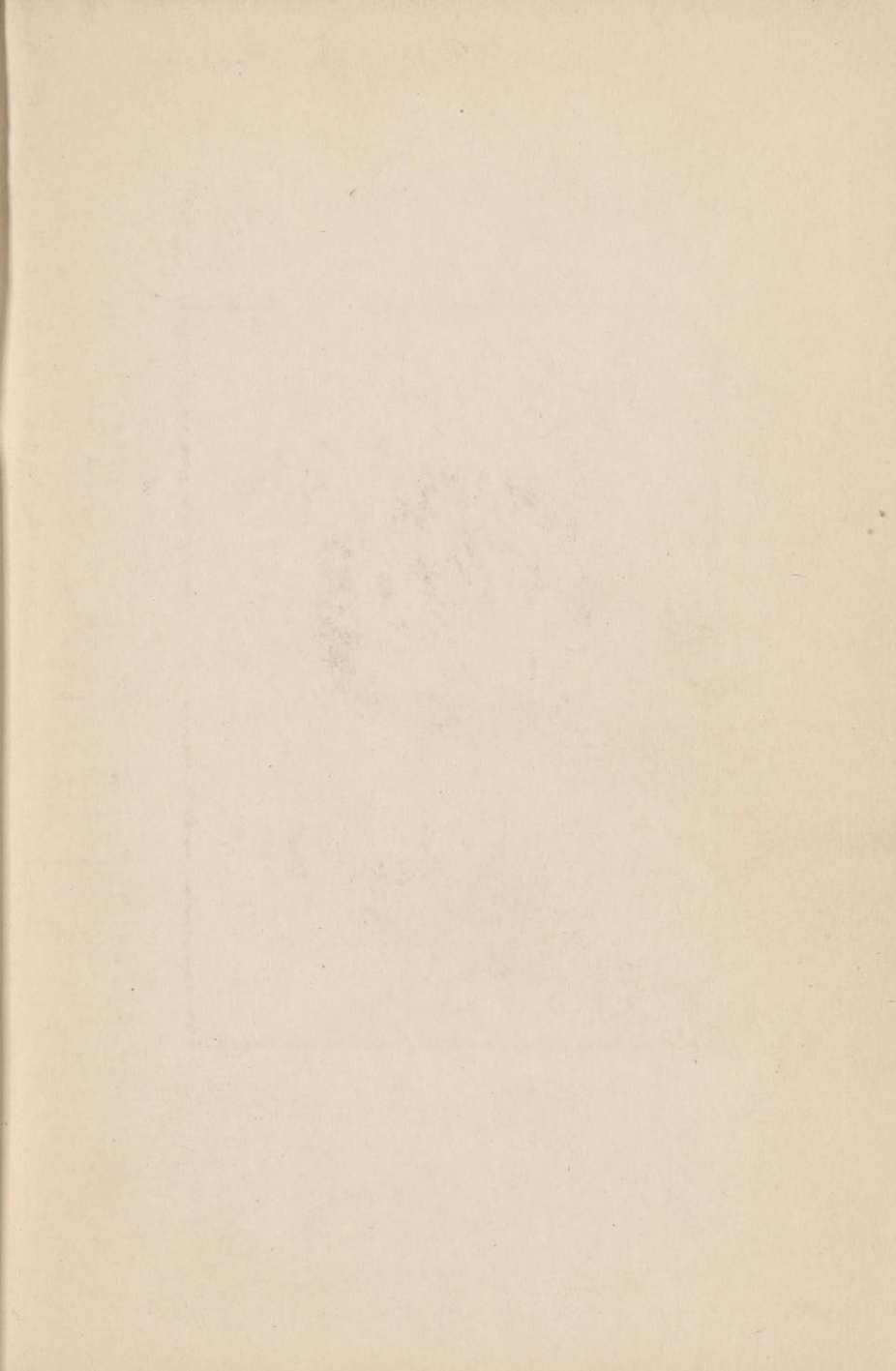
TRIP



3 9080 02557 0943



LIBRARY
OF THE
MASSACHUSETTS INSTITUTE
OF TECHNOLOGY



PERSONAL HYGIENE FOR NURSES

613.02
B94

MASS. INST. TECH.
JAN 10 1925
LIBRARY

PERSONAL HYGIENE

FOR NURSES

ADAPTED ALSO TO THE USE OF STUDENTS OF PHYSICAL EDUCATION
AND OTHER HEALTH SPECIALISTS

BY

JOHN WYMOND MILLER BUNKER, PH.D.

Associate Professor of Biochemistry and Physiology, Massachusetts Institute of
Technology; Lecturer in Physiology, the Boston School
of Physical Education

AND

CLAIR ELSMERE TURNER, M.A., C.P.H.

Associate Professor of Biology and Public Health, Massachusetts Institute of
Technology; Associate Professor of Hygiene, Tufts College
Medical and Dental Schools

ILLUSTRATED

ST. LOUIS
THE C. V. MOSBY COMPANY

1924
✓

COPYRIGHT, 1924, BY THE C. V. MOSBY COMPANY

(All Rights Reserved)

Printed in U. S. A.

*Press of
The C. V. Mosby Company
St. Louis*

TO THOSE
IN WHOM THE DESIRE TO SERVE
HAS INTENSIFIED THE WISH TO MASTER
AND TO FOLLOW
THE RULES OF PERSONAL HEALTH

PREFACE

The facts of hygiene contained in this volume are presented with an appreciation of the nurse's high ideals of service and in the belief that she regards the maintenance of personal health as both a fundamental duty and a matter of professional pride. Every nurse, whether she is conscious of it or not, is teaching those she serves in matters of health and disease. She will use the facts of personal hygiene professionally in the sickroom and among the families with whom she comes in contact. We have presented the facts, therefore, not as a list of rules but in the light of the scientific physiological bases upon which they are found. We have consciously and intentionally chosen the physiological approach because it is only with an appreciation of the scientific facts which underlie the art of healthful living that one can confidently or intelligently develop its practical applications. In doing this we expect that the student will apply the knowledge to her daily life in the most concrete, specific and practical manner, and that her practice will be the more sound and consistent because of her scientific background.

THE AUTHORS.

Massachusetts Institute of Technology
October, 1924.

CONTENTS

CHAPTER I

HEALTH	17
Hygiene, 18; Causes of Health, 19; The Study of Health, 20; The Human Mechanism, 20; Efficient Living, 21; Health Fads, 22; The Game of Life, 23; Hygiene for the Nurse, 23; Hygiene Applied, 25; The Value of Health, 25.	

CHAPTER II

FOOD AND DIGESTION	26
Work and Energy, 26; Laws of Energetics, 27; Food and Energy, 27; Bottled Sunlight, 28; Carbohydrates, 28; Proteins, 29; Fats, 29; Absorption of Food, 29; Membranes, 33; Digestion, 33; Splitting of Proteins, 34; Splitting of Carbohydrates, 36; Cleavage of Fats, 37; The Unit of Energy, 38; Wastes, 40; The Utilization of Food, 42.	

CHAPTER III

THE MOUTH	45
Teeth, 45; Evils of Tooth Decay, 46; Sixth Year Molars, 46; The Nature of Decay, 48; Prevention of Decay, 49; Dental Inspection, 50; Tartar, 50; Dislodgment of Food Particles, 52; Pastes and Powders, 53; Oral Cleansing, 53; Care of Soft Tissues, 55; Focal Infections, 55.	

CHAPTER IV

THE ALIMENTARY TRACT	58
Psychic Secretion, 59; Why the Mouth "Waters," 60; Fletcherism, 61; Sensible Eating, 64; Water, 64; Choice of Food, 64; Eating Habits, 65; Mental State, 66; Intestinal Digestion, 67; Constipation, 68; Peristalsis, 68; Laxatives and Cathartics, 69; Posture and Digestion, 69; Regularity in Bowel Habits, 70.	

CHAPTER V

THE NERVOUS SYSTEM	73
Arrangement and Function of Nerves, 73; Sensory Stimuli, 74; The Autonomic System, 75; Effectors, 75; Receptors, 76; The Nerve a Living Cell, 77; Emotions, 78; Habit Formation, 79; Cheerful Philosophy, 80; Worry, 81; The Soldier's Creed, 81; Mind and Health, 82; Hobbies, 83; Forget Symptoms, 83; Instincts, 85; Control of Instinct, 86; Care of the Nerves, 89; Personality, 91; Confidence and Success, 92.	

CHAPTER VI

MUSCULAR EXERCISE	94
Lymph and Blood, 95; Food, 96; Waste, 96; Lymph Movement, 100; Respiration and Lymph Movement, 101; Exercise and Lymph Movement, 102; Exercise and Blood Circulation, 103; Congestion and Its Relief, 104; Exercise and Respiration, 105; General Benefits from Exercise, 105; Types of Exercise, 106; "Stomach In," 106; Posture, 107; Sitting, 108; Lounging, 108; Fatigue, 109; Fatigue Substances, 110; Recovery, 112; Body Mechanics, 113; Standing Position, 114; Trunk Muscles, 115; Stooping, 116; Curved Spine, 117; Appearance, 117; Sacroiliac Strain, 118; Benefits from Correct Body Mechanics, 119.	

CHAPTER VII

FEET	121
Foot Structure, 121; Foot Troubles, 124; Arches, 125; Remedies, 127; Bunions, 129; Bone Bruises, 129; Shoes, 130.	

CHAPTER VIII

SLEEP	133
Hours of Sleep, 134; Wakefulness, 135; Position for Sleep, 135; The Mind in Sleep, 136; Prevention of Insomnia, 138.	

CHAPTER IX

CLEANLINESS	139
A Clean Skin, 139; Bathing, 139; Odors, 140; Clean Smells, 140; The Morning Bath, 141; The Reaction from	

a Cold Bath, 141; Body Temperature Regulation, 142; The Cold Bath, 144; The Hot Tub Bath, 145; The Healthy Skin, 146; Hair, 146; Care of the Scalp, 147; The Shampoo, 147; Bobbed Hair, 148; The Nails, 149; Cleanliness and Personality, 150; Biologic Cleanliness, 150.

CHAPTER X

NUTRITION	151
Diet, 151; Vitamines, 152; Minerals, 154; Prenatal Diet and Teeth, 155; The Balanced Ration, 155; Kinds of Protein, 157; Amino Acids, 157; Adequate Proteins, 158; Amount of Protein, 159; The Individual Requirements, 159; The Adequate Diet, 160; Excess Protein, 160; Weight, 161.	

CHAPTER XI

THE ENDOCRINE GLANDS	164
Thyroid, 164; Adrenals, 164; Goiter, 165; Gonads, 165; Insulin, 166.	

CHAPTER XII

REPRODUCTION	167
The Physiology of Reproduction, 167; Reproduction in Simple Forms, 167; Conjugation, 168; Reproduction in Man, 169; Ovulation, 170; Menstruation, 170; Pregnancy, 171; The Corpus Luteum, 172; Nerve Reactions, 172; Puberty, 173; Wholesome Instruction, 173; Sex Instinct, 174; Mental Attitudes, 174; Hygiene, 175; The Climacteric, 176.	

CHAPTER XIII

ADAPTATION TO ENVIRONMENT	177
Ventilation, 177; Carbon Dioxide, 178; Temperature, 178; Humidity, 179; Favorable Air Conditions, 179; Mental Work and Ventilation, 180; Drafts, 180; Clothing, 181; Communicable Diseases, 182; Classification of Communicable Diseases, 183; Natural Defenses, 185; Specific Immunity, 185.	

ILLUSTRATIONS

FIG.	PAGE
1. Diagram of the passage of molecules of different sizes through permeable membranes	32
2. Diagram of tooth structure	48
3. The correct manner of using the tooth brush	54
4. Dental caries and focal infection	56
5. Bones of the right foot, dorsal aspect	122
6. Bones of the right foot, inner aspect	123

PERSONAL HYGIENE FOR NURSES

CHAPTER I

HEALTH

Health is the result of proper living. It is a condition which indicates soundness of body and mind. The word "health" is sometimes used to refer to the condition with respect to *degree* of soundness, but its true meaning does not admit of this interpretation. By derivation the term means "wholeness." It does not come from the word "heal" as one might think from its spelling. As there can be no degree of wholeness except the superlative, so there can be no such thing as comparative health. There is either health or in some degree lack of health. This, the true meaning of the word, is retained for the study of hygiene.

Health is a goal, a height to be achieved and retained. The means of attaining and retaining health is the practice of personal hygiene. Every adult knows something about the minor ailments of life. Few persons realize that these same minor ailments are largely avoidable. The youngster learns by experience, if not from precept, that there is a relation between eating green apples and a common physical ailment of childhood. When he grows up, if he has forgotten his lesson, he may come to the time when he envies his fellow man a sound digestion.

Most often, when we think of health at all, it is really lack of health that engages our attention. Thinking about lack of health can accomplish little good unless

the mental process is accompanied by the ability to examine critically and to prescribe intelligently. It is not good to think too much about one's personal comfort, or discomfort. Discomforts are increased by attention of the wrong sort. The trained individual learns how to meet discomforts with a healthy mental attitude. He is able to plan constructively how to abolish them and does not uselessly fret. To investigate the causes which operate to bring about health or something less than health and to make personal application of the results of such study is both interesting and practical.

The expert in any line finds that new problems in his field become a challenge to his reasoning power, and he meets them with eager interest. When one understands the basic principles which govern health, one is better prepared to maintain health no matter what new conditions arise.

Hygiene

The body of fact which has been established as explaining the causes of health, and therefore, indirectly, the causes of lack of health has been designated as the science of Hygiene. Every useful practice which involves the intelligent use of established laws and principles is an art. There is an art of maintaining health which, in short, is the practice of the scientific principles of hygiene. The science of hygiene, then, includes the established facts as to cause and effect which govern health. The art of hygiene is the application of these same principles. Science unused accomplishes nothing useful. The mastery of a science is an intellectual achievement, but again nothing useful is accomplished by such mastery except possibly intellectual exercise. It is only in the intelligent application of the principles

of a science that it becomes of value to mankind. Hygiene is no exception to the rule.

If one is to apply hygiene, he must first of all master the science, but the effort must not stop there. One must apply what has been learned. Health is a possession which is too often lost through ignorance or inertia. A priceless possession, one may say the most priceless possession of mankind, its enjoyment is permanent only if one takes thought for its preservation. The time to assure lasting possession of this gift is before it is gone. While we have it, its preservation is a joy. To regain what has been lost is always in some degree an arduous task.

Causes of Health

Civilized people in the past have been more interested in studying the causes of disease than in giving attention to the causes of health. There is something spectacular in discovering the cause of disease and in devising a cure. How much more logical it is to study the cause of health and so be able to maintain that with which the individual is normally endowed.

The causes of health are, in the main, physiologic, having to do with the proper function of the various parts which go to make up the living body. They include such matters as the condition of our body fluids; the bony supporting structures; the muscles which overlie these structures and the coverings of the whole; the efficiency of our system of communications, which we call the nerve system; the efficiency of our bodily chemistry, which enables us to borrow energy from the food we digest; and the functioning of each separate inter-related organ in the body. Life and living involve a constant functioning of these various systems, and it is

the purpose of this book to present the essential facts concerning the causes of health, and the art of maintaining it.

The Study of Health

In the study of this subject it is highly important to gain the correct mental attitude of approach. An impersonal investigation of facts which are capable of general application is the attitude which is beneficial. Attention to one's self, exclusively, sooner or later takes on some degree of attention to one's imperfections. To stop there is not desirable. By thinking about ailments one is likely to relapse into an attitude of self commiseration or even worry, an attitude which is positively harmful and one which obscures perspective. One who is mechanically inclined studies a machine to see what makes it go smoothly, not to satisfy a morbid curiosity concerning possible mechanical troubles. That is the way to study hygiene, to find out what makes the body "go." Having discovered and supplied the necessary fuel and lubricants, having made necessary adjustments, and having learned how much work the machine can accomplish without undue wear, one can then use the human mechanism to its fullest capacity for smooth, efficient work.

The Human Mechanism

The highest praise which we can render to a complicated automatic mechanism is to say that it seems almost human. By implication, therefore, the human being is the highest type of machine. To think of the human body as a machine is a helpful idea to the student of hygiene. The various parts of the body are interrelated in their functions just as are the various parts of a

machine, and the result of the smooth functioning of these parts is to produce work. When the machine runs smoothly it turns out results efficiently. When the human mechanism runs smoothly it makes possible a life not only efficient but also joyous.

Efficient Living

One automobile owner takes pride in the appearance of his car, and keeps the paint bright and the nicked parts polished. Another is interested also in what is under the outer shell. Which one travels more comfortably for the longer distance is obvious. The second individual while traveling the highways is on the alert for any symptom of unusual character in the running of his motor. He lubricates when necessary, he has repairs made by an expert if required, he detects trouble at its start and remedies the improper condition at once. It is only the careless driver who, on noticing that his machine is beginning to ride roughly, ignores the condition and decides that it will go for a while any way and neglects to remedy the irregularity.

Many human mechanisms are knocking and growling through the journey of life without any intelligent attention, partly because the owners realize that they are still going "after a fashion," and partly because the owners do not know what to do about it. Some of us are too prone to "peg along" instead of trying to live at our best speed and efficiency.

How often do you rise in the morning wide awake and eager to tackle the day's work? How often do you wake with a yawn, rubbing your eyes so that you can see the clock and debate whether or not you can snatch a few more winks? Did you ever see a baby wake up?

At one moment the baby is asleep, but literally in the twinkling of an eye it is wide awake and active. It undoubtedly is possible to maintain long through life this ability to wake up eager and ready for the day's living. The baby wakes in such a manner because it is a healthy human mechanism refreshed and renewed by its sleep. Its sleep has been of restful quality and of sufficient duration to restore its possessor to normal healthy waking. Its restoration has been sufficient to overcome the fatigue of the previous waking hours, or to put it the other way, the work done in the previous day has not been too great for the amount of restoration possible in its period of sleep.

Health Fads

Many persons are today playing with radio. The body of fact concerning what forces are at work in radio is at best incomplete. The layman knows very little of these meager facts. He twirls dials and pushes this and that until something happens. He is prone to seize eagerly any suggestion for betterment of results if only the suggestion is made assertively enough. He is willing to try almost anything because he himself is unable to judge whether suggestions received are wise or foolish. A person who knows nothing of the causes which underlie health is in a similar position when he tries to regulate his living. He lends a ready ear to quacks and charlatans who offer him advice purely for the good of their own pockets, but under the guise of extending a helping hand. Such ignorant individuals become faddists, and at one time restrict their diets to leaves and nuts, at another time decide they must consume red meat in order to gain strength, or must imbibe nauseating compounds of unattractive appearance. A

tonic that has extensive testimonials from baseball players or other athletes, pugilists preferred, meets a ready sale among such individuals. There seems no limit to the number of suggestions which such pitiable persons will pick up and discard one after the other in a search for something they have lost, namely, the condition of health. They include in their number those who are too lazy to learn the causes of health or to act intelligently upon such knowledge.

The Game of Life

A game is interesting only if there be an opponent. It is mastery of difficulties which exhilarates the player. To maintain health, if there were no difficulty about it, would be a tame affair. To maintain health under all sorts of conditions of living—and most of us meet all sorts and conditions of living—becomes as interesting as any other contest.

The handy man about the house can take a watch or an egg beater or a phonograph and sometimes fix it. While he may never have studied the particular mechanism involved nor have ever met the particular difficulty which has arisen, he has a broad sense of mechanical principles and can therefore make an intelligent diagnosis of what is the underlying cause of the obvious misfunction. The practicing physician meets constantly cases which have in them some element new to his experience, but with his broad knowledge and appreciation of fundamental function he can reason from effect back to probable cause, and so prescribe intelligently.

Hygiene for the Nurse

The nurse is subjected to irregular hours of work, and irregular periods of physical and mental strain. Few

persons are confronted with conditions more difficult for maintaining personal health, unless it be her professional colleague, the physician. It should be a matter of professional pride with her to achieve a degree of familiarity with the underlying causes of health in order that she may adapt her habits of living to the arduous and exceedingly variable demands made upon her incident to her professional service. The more difficult the task the greater is the satisfaction in achievement.

It would seem, therefore, that the study of personal hygiene must be especially attractive to the nurse since not only does it become a game with unceasingly changing odds, but since also it is part of her professional equipment to become expert in this field of knowledge. The nurse who understands the principles of hygiene is in position to render extra service to her patients. It is not expected that she shall prescribe medicines, but it is her duty to make her patients comfortable physically and mentally, and by the degree with which this object is attained is her success measured. She can do this understandingly and have great personal satisfaction if she be able intelligently to make sound suggestions now and then of the little things which speed the recovery of her patient. In all fields of professional endeavor the rewards are commensurate with the value of service rendered. The nurse who can do more than mechanically carry out instructions is the one whose services will be in greatest demand. The nurse therefore may be sure of a double reward from the study and mastery of the subject of hygiene; reward in personal gain from practicing what she has learned and an indirect reward from her ability to render a higher degree of useful service to her fellow man.

Hygiene Applied

Study of a science without application of what is judged to be sound practice is almost useless. When one has mastered a body of facts he must then decide whether or not it is worth while to try out what he knows. It is only by trying that we find out the soundness of our learning. The right place to try out such information is upon one's self whenever opportunity may arise. The rather common attitude of regarding the study of hygiene with good-natured tolerance or impatient indifference is exceedingly unfortunate. It may have arisen through well-intentioned but injudicious preaching of definite rules for living rather than a balanced consideration of broad underlying principles which are the real causes of health. When one is adequately convinced of the truth of these principles, a logical application of them becomes a reasonable expectation.

The Value of Health

Health is the prime prerequisite to contentment. Without it there is not happiness. Living is a joy to him who has a healthy body, and its concomitant, a healthy mind. Health is the result of definite causes largely controllable through the exercise of intelligence. Given a sound physical inheritance, when living is so ordered that these causes become operative, health is the inevitable result.

CHAPTER II

FOOD AND DIGESTION

Work and Energy

The business of living involves constant changes in the body. Every time anything moves, it means that some energy is used. When the heart beats, energy is employed. When we breathe, the lifting of the walls of the chest is accomplished only by the application of energy. When food is digested, it is because chemical energy is available for the digestive process. Some persons seem to be full of energy, others at times feel as if they had no energy.

One kind of energy can be transformed into another. The energy that swings a baseball bat imparts to the ball, when the bat connects with it, enough energy to send the ball traveling through space. The traveling ball has enough energy to sting the hand of the person who catches it. Heat is a form of energy and can be transferred partly into other forms of energy, as, for instance, the heat of the stove may change water into steam, which in turn can be used to give back heat or turn an engine, or cook food. The cooking of food means chemical changes in the food substance and these chemical changes are induced by heat. The hotter the stove the faster the food cooks, within reasonable limits, and this means that heat makes chemical change go on faster.

The body has heat greater than the amount of heat surrounding it. This body heat serves to speed up

chemical changes in the body tissues. These chemical changes result in various types of conversion of energy to the requirements of living.

Laws of Energetics

When we do work such as moving heavy objects from one place to another, we have spent energy so far as we are concerned. We cannot get it back. It is a universal law, too, that energy cannot be created or lost, it can only be stored or changed. Where is our apparently inexhaustible source of energy for living? It seems to be inexhaustible, but if one were to go without food for a time he would, of course, become weak, which is another way of saying that his store of energy has become lowered. Continued fasting leads to starvation and ultimate death. Food, then, is a source of energy. In fact, food is the one source of energy so far as the human body is concerned, and one of the first considerations, therefore, in the study of maintaining healthy vigor must have to do with the amount of food required.

Food and Energy

It will be shown that not only is the amount of food required for adequate living an important thing to know, but also that it is important to know the best kinds. In specifying goods for a gown one purchases so many yards, not of "cloth" but of cotton cloth, or woolen or silk goods, according to the purpose which the gown is to serve. If it is to be an all round work dress one kind of cloth is selected, but for special occasions and needs, special goods are indicated. So with food, not only is the amount important, but also the kind.

Needles and thread, buttons and trimmings, all have their parallel in dietary requirements which enable the body to knit together the various foodstuffs into protoplasm or to convert them into energy. A load of bricks and a pile of sand and mortar will not make a house without artisans to put them together. Foodstuffs alone, although of the right kind, will not build a growing body without certain substances to make them utilizable within the body. These aids to the utilization of food in the body are called vitamins.

Bottled Sunlight

One wonders, perhaps, where the food got its energy. All foods were once upon a time part of plants or animals. As plants or animals they were living things, expending energy in living. Where did they get it? The answer is one of the mysteries which the biologist has solved. Plants obtain their energy from the sun. There is in the sun's rays, beside the energy which appears as light and as heat, another form known as radiant energy. This radiant energy is caught by the green substance of green leaves in sunlight, combined with water from the soil and with the gas, Carbon Dioxide, from the air. The three elements C, H, and O are combined by chemical changes into one new substance which has been called "bottled sunlight" but more commonly is known as starch.

Carbohydrates

Starch is stored, as in the potato, or is converted into sugar in other plants such as the sugar cane. Both starch and sugar contain bottled-up energy which under suitable conditions can be released and converted to

other kinds of energy. Starch or sugar in a package as purchased from the grocer, or in a natural package, such as a potato, retains its energy until suitable conditions occur for its release. These conditions are supplied in our own bodies by the chemical processes of digestion, absorption, and oxidation in the body.

Proteins

In addition to starch, plants manufacture another kind of substance which becomes one of the basic foods. It is the basis of all structural living tissue and is called protoplasm which, literally translated, means the first tissue. All living cells of plants or animals contain protoplasm. When this tissue dies, it is called protein. Proteins are necessary as part of the food of all animals, including man. Protein contains chemical elements similar to those which make up starch, namely, carbon, hydrogen and oxygen, but in addition it always contains the element nitrogen. Most natural foods contain both starch or sugar and protein.

Fats

The third class of foodstuffs is that kind of plant or animal substance which is called fat. Fats are made up principally of hydrogen and carbon with less oxygen than is present in the sugars. Animal fats are well known in the form of lard or butter, but not all realize that cocoanut oil, peanut oil, and the so-called nut margarines are true vegetable fats.

Absorption of Food

Food, as it enters the mouth, is rarely in a condition to be of service to the body. The mouth is only one

end of a hollow tube that extends with unbroken walls through the body. Before food can be utilized in the body proper it must pass from this tube, the alimentary tract, through its walls into the body proper. To understand how this can take place we must recall the old experiment in physics or chemistry in which the principle of osmosis is illustrated. Osmosis is an exceedingly important part of living and its thorough comprehension is necessary to an understanding of the hygiene of digestion.

If a sac of parchment or of animal membrane, such as lines the digestive canal of animals, be filled with a solution of sugar dissolved in water and immersed in unsweetened water, in a short time it will be seen that the level of the liquid inside the bag has been raised, meaning that the volume of watery solution in the bag has increased. At the same time the volume of water outside the bag has been correspondingly lessened and its level therefore is lowered. One is tempted to say that the water outside has leaked in, and in a sense this is true. However, the bag has no hole in it that can be detected even by the highest powered microscope. This phenomenon can be explained by stating that the water from the outside saturates or soaks up into the membrane until the membrane can hold no more. At the same time the membrane is being soaked up with water from the inside but this water contains molecules of sugar in solution and the membrane becomes supersaturated with sugar molecules at its inside surface until no more sugar molecules can get into it. Now the membrane full of water, in the sense that a blotting paper becomes filled with water, supplies some of this pure water to dilute the saturated sugar solution inside, thus passing pure water from outside the bag to

the inside. This is the way that water gets from the body into the intestine, keeping the feces moist.

But there is more to this experiment. After a long time, if the membrane be of the right kind, the water outside the bag will begin to have a sweetish taste showing that some sugar has worked its way out. This can be explained by assuming that the bag which to all ordinary tests is tight and without holes has nevertheless minute spaces between its solid particles, holes which may be one-millionth of one millimeter in diameter. (A millimeter is one twenty-fifth part of an inch, about the width of a pin head.) These fine pores are large enough to let an occasional sugar molecule through, and, of course, since a sugar molecule is very much larger than a water molecule, these "holes" will let water molecules through. (See Fig. 1.)

In any solution, the water and the substance dissolved in it exist as molecules, minute masses which dart to and fro, collide with each other and the sides of the vessel, maintaining a constant motion. These molecules cannot pass through the walls of a goblet because the glass has pores too small to let them through. Paper or parchment or animal membrane does have pores large enough, consequently every once in a while a molecule makes a direct hit into one of these holes and instead of bouncing back it plunges through to the other side.

What, then, is the picture at the beginning of the experiment? A bag of membrane having in it a certain number of molecular sized holes is bombarded from the outside by minute water molecules, and from the inside by minute water molecules of the same size but also by some larger sugar molecules. Some of the holes are large enough to let through either kind of molecules, some holes will let through only the small molecules.

Every time that any molecule on the pure water side of the wall hits a hole it shoots through. But every time a sugar molecule inside hits a small hole, it sticks or bounces back. While it is blocking the hole, no water or

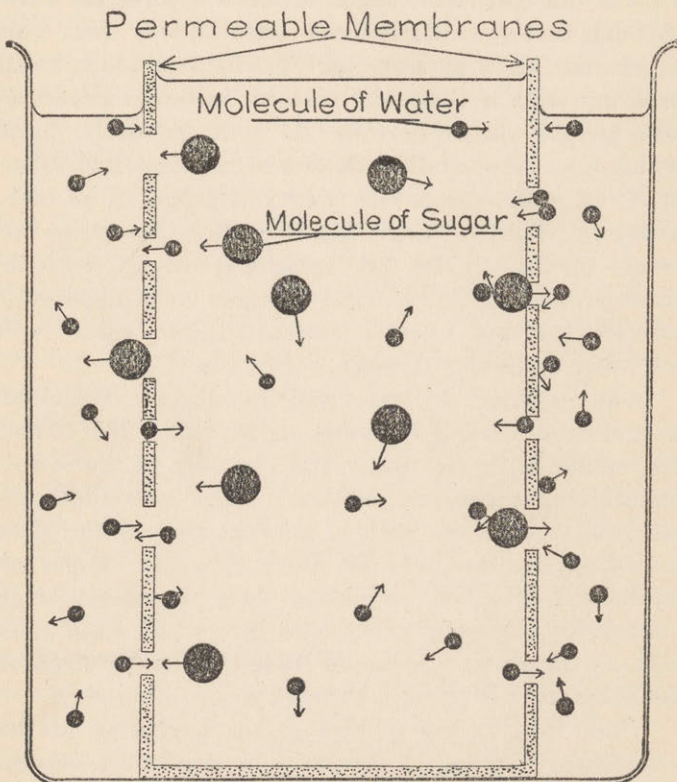


Fig. 1.—Diagram of the passage of molecules of different sizes through permeable membranes.

molecule on its own side can get through to get out. Therefore many of the direct molecular hits from the inside go for naught, but every hit from the outside

counts. You can see that more water gets in than gets out. Once in a while, depending on the relative number of large holes, a sugar molecule breaks through and starts cruising about in the outside solution. Given time enough, the number of sugar molecules will eventually be fairly evenly distributed between the inside container and the outside one. They will continue to pass back and forth but in equal amounts in both directions.

Membranes

A membrane which will allow some molecules other than water molecules to get through occasionally is termed by the chemist permeable. All the membranes of our body, those which surround each cell and those which line the alimentary tract are permeable. Some will pass molecules up to a given size, others will pass larger ones, others only smaller ones. A given membrane may even change its permeability, allowing comparatively large particles to pass at one time and preventing their passage at another time.

There is always an upper limit to the size of any molecule which can pass, and rarely does food as it enters the mouth exist in small enough molecules to get through any membrane. The processes of digestion break up the aggregates of food, render parts of each food soluble and these solutions contain molecules small enough to pass the membranes of the body.

Digestion

The first process in digestion is mastication. By the action of the teeth the closely packed mass of foodstuffs is torn, crushed and disintegrated into smaller masses still closely packed in structure. While the food is be-

ing chewed it is also being moistened. Until the particles are small enough and moist enough they cannot pass on to the next process through the act of swallowing. Try to swallow a dry cracker after first wiping the mouth dry with a clean handkerchief. It cannot be done until the dry cracker crumbs have been moistened.

The mass of food, thoroughly moistened and ready to swallow is called a bolus. The bolus of food passes through the esophagus to the stomach. In the stomach one part of the digestive process takes place. Digestion in the stomach is mainly a chemical cleavage of the protein part of food. Other digestible parts of food are taken care of further down the alimentary tract as will be explained later.



Splitting of Proteins

Gastric digestion, named from the Greek word "gaster," meaning "stomach," results in separating the protein part of food from the other parts and in splitting the protein masses into a fine state of subdivision in which state the individual protein fractions become soluble. Protein in solution, like other substances in solution, separates into molecules. The particular small portions of the original protein which are the result of the splitting process in the stomach have a name of their own. They are called peptones, and from their origin are sometimes classed as derived proteins. These derived proteins are still too large, for the most part, to pass a permeable membrane. Accordingly, there is no passage of derived proteins through the walls of the stomach. The physiologist states this fact in another way by saying that there is no absorption of protein food from the stomach.

The digestive process of the stomach, then, is in one

respect like the first step of alimentation, a partial subdivision of the protein mass, but not the final stage of subdivision. The preliminary treatment of protein which goes on in the stomach is finished in the small intestine into which the stomach contents are released from time to time. This final stage in protein disintegration is termed intestinal digestion.

The final stages of digestion in the small intestine are again carried on by a chemical process. The digestive juices which contain the active agents of digestion are responsible for this chemical action. In the stomach, gastric juice is secreted by certain cells in the lining of the stomach. At the same time hydrochloric acid is secreted from the walls of the stomach. These two secretions mingle in the cavity of the stomach and there come in contact with the food as it arrives. The digestive juice of the intestine is secreted largely by the cells in the pancreas from which these secretions pour through the pancreatic duct into the small intestine. These secretions are alkaline, and have three main digestive functions, the splitting of peptones, carbohydrates, and fats.

It is in the small intestine that the major part of digestion takes place. One thing that happens there as the result of the mixing of pancreatic juice with partly digested food from the stomach is a further subdivision of the protein particles to a stage known to the chemist as amino acids. These are the ultimate states of subdivision of protein. The result of protein digestion is the conversion of the original material into amino acids. These amino acids are soluble and their molecules in solution can pass through the permeable membranes of the body. From the small intestine, therefore, we have absorption of amino acids.

On the body side of the intestinal walls there are many small blood vessels. The amino acids diffuse through the intestinal membrane, through the membranes which surround the blood vessels, and thus the digested protein finds its way from the intestines into the general circulation. By the blood these amino acids may be carried to various parts of the body and ultimately may be utilized by living body cells to make new protoplasm.

Splitting of Carbohydrates

The fate of carbohydrates in digestion is somewhat similar. Carbohydrate digestion, however, starts in the mouth where the food is moistened. This moistening process adds not only water to the food bolus, but also certain active chemical agents which react upon carbohydrates alone. These chemical agents are in the saliva, and by their agency complex carbohydrates may be partly split into simpler carbohydrates. This salivary digestion is very rapid, and if food is chewed carefully, this type of digestion of complex carbohydrates may accomplish much. If the food is bolted, there is not time for much salivary digestion. In any case, the end products of salivary digestion are not sufficiently finely divided to make absorption possible.

Little if any digestion of carbohydrates goes on in the stomach after the food is thoroughly mixed with gastric juice, and only very simple carbohydrates are absorbed from the stomach and these in negligible amount. It is fair to state that practically no absorption of carbohydrates occurs from the stomach, and practically no carbohydrate digestion takes place there.

It is true that an exception to this last statement occurs when the stomach becomes packed with food, for

in that case the last bolus to arrive remains in the upper end of the stomach for some time before it is mixed with gastric juice. Meanwhile, if the food has been well mixed with saliva, some further digestion due to the active elements of the saliva may continue even though the restricted mass of material is enclosed within the stomach walls.

The form of carbohydrate most commonly taken into the mouth is starch. Starch, as has been pointed out, is formed in plants and so food derived from plants generally contains this substance. Cereals offer an example. Before starch can be absorbed it must be reduced by chemical cleavage until its molecules are sufficiently small to pass the necessary membranes. When in this final state of subdivision the starch molecule has been so changed that it is no longer called starch. It is sugar. The simple sugars are absorbable and can leave the intestine for the blood stream.

The final stage in this subdividing occurs in the intestine aided by a second class of chemical substances in the pancreatic juice. While one part of the pancreatic juice is working upon protein to form amino acids, another part of the same fluid is working upon carbohydrates of varying degrees of subdivision to effect the final stage of sugar. Carbohydrate digestion and absorption usually depend, therefore, in the final analysis upon the activity of the pancreatic fluid, and carbohydrate absorption into the blood stream is from the small intestine.

Cleavage of Fats

The third class of nutrient substances, the fats, undergoes merely mechanical subdivision in the mouth and stomach, and is subjected to chemical cleavage only in

the small intestine. Here again the active agent of this splitting is in the pancreatic fluid, aided by the bile which also flows into the intestine at a point very close to the pancreatic duct. The end products of fat digestion are glycerin and various acids of a group named fatty acids because they are derived from fats in nature. The fatty acids and the glycerin alone are separately absorbed through certain portions of the intestinal wall but they do not pass directly into the blood. Instead, they are recombined into droplets of body fat at once and enter the lymph system rather than the blood stream. Of course, the lymph eventually pours into the blood stream near the heart and carries with it these combined fats in minute dust-like motes.

Digestion is, therefore, a provision for a mechanical tearing apart of complex foodstuffs, a separation of the useful from that which cannot be utilized (such as plant and animal fiber, bone, gristle, etc.) and a final chemical subdivision of these useful portions to such a state that their molecules can pass the permeable membranes of the intestine, the blood vessels, and the cell membranes of the body.

Mere eating of food is of no value unless digestion follows, and digestion is of value only in so far as absorption keeps pace with it. Any break in the chain renders the whole process worthless. Any impairment of any part of the process interferes with our supply of energy, for the only source of bodily energy is food which has been digested and absorbed.

The Unit of Energy

Since food is the source of the energy of living, it becomes important to know if all foodstuffs have equal energy value. To make a comparison of energy values

of foods there must be some unit of measurement of energy value. Such a unit is the amount of energy which can be derived from a given food substance in the form of heat. Heat is taken as the means of measuring this available energy because it can be measured quantitatively with accuracy. The unit which has been adopted is the large calorie.

A calorie is the amount of heat which will raise the temperature of one thousand grams of water one degree Centigrade. This unit applies to the fuel value of sawdust, paper, sugar, protein, fat or anything else which can be induced to give up heat upon chemical combination with oxygen. When fuel burns it is being combined with oxygen, or being oxidized, as the chemist says. A piece of paper may be induced to burn rapidly, while a piece of punk, such as is used to ignite firecrackers on the Fourth of July, burns slowly. In each case the burning is true oxidation. In the utilization of foodstuffs in the body we have a still slower rate of burning or oxidation, and the energy liberated in this process may result in heat, warming the body, or it may be converted into muscle work or other kinds of energy. After absorption there comes ultimately oxidation of much of the food we take in.

By means of many measurements which will not be described, it has been found that the energy value to the body for nearly all *protein* foods after they have been digested and absorbed is equivalent to four calories for each gram of protein. All proteins may be grouped together in computing energy values and on this score any protein is practically as valuable as any other protein. In the case of *carbohydrates*, whether we start with a simple sugar or a complex starch, the energy value is again a constant value for each gram of carbo-

hydrate, and it happens that the energy value of carbohydrates is the same as that for protein, namely, four calories of energy for each gram. *Fats*, however, have a different energy value. One gram of fat will supply nine calories of energy to the body. To summarize, therefore, the energy values of foodstuffs are approximately as follows:

One gram of protein yields	4 calories
One gram of carbohydrate yields	4 calories
One gram of fat yields	9 calories

These values apply to the protein, carbohydrate, or fat portion of all food. It must at all times be remembered that foods as we take them contain water, salts, connective tissue and indigestible fibers, varying in amount and proportionate distribution in the various substances classed as food. The indigestible fractions of food may have a value and some of them have great value, but it is not energy value and cannot be computed in calories.

As we shall see in the chapter on Nutrition, the various foods have various uses, and two portions of food of the same calorie value may be utilized for quite different purposes in the body. Energy value is only one of the many standards by which the diet is chosen.

Wastes

As a result of any oxidation we have certain residues which cannot further be oxidized. In bodily oxidation there are residues which are incapable of yielding further energy to the body. They are commonly called waste products. These waste products are excreted. Nitrogen is borrowed by the body, built up with other

elements into protoplasm and ultimately discarded as waste nitrogen in the chemical substance known as *urea*. Urea diffuses into the blood and from the blood to the collecting urinary tubules of the kidney, whence it finds its way to the urinary bladder, being voided from the body from time to time in the urine.

Carbohydrates completely oxidized are converted into carbon dioxide and water. The carbon dioxide diffusing into the blood forms a temporary union with the red blood cells and ultimately breaks from this union as the blood courses through the small vessels in the walls of the lungs, the gas diffusing through the membranous walls of the lungs to the air inside the lung cavity. From this point it leaves the body in the expired breath.

Water finds its way through the body membranes, some of it as perspiration to the skin from which it evaporates, some of it to the urinary collecting tubes where it makes up the bulk of the urine, some of it through the intestinal walls to the food mass therein.

Mineral salts are present in the body in fairly constant amount. More mineral salts are added in the daily food intake. The balance is maintained by a corresponding excretion of mineral salts. These are given off largely in solution through the kidneys and to some extent through the pores of the skin in perspiration. In the latter case the evaporation of perspiration leaves a deposit of these mineral substances on the skin which must be removed by bathing.

The feces consist of undigested food residues and partly or completely digested food which has not been absorbed. Bile from the liver also finds its way into the fecal material and is to be considered partly as an excre-

tion. Salts also find their way with water into the feces and may be excreted in this manner.

The amount of waste material varies largely with the energy conversion in the body. In times of severe work there will be a correspondingly large amount of oxidation with the resultant large amount of oxidized waste products. During rest periods the waste materials are in smaller amount. An exception to this general rule is in the excretion of nitrogen which varies not with work done but with nitrogen intake. As before stated, nitrogen is borrowed by the living cells in amount just sufficient for the needs of replacing worn out cells or building new protoplasm. The amount required for this is rather small in proportion to the ordinary nitrogen intake of the person who does not regulate his diet with this point in mind. Accordingly, there is usually a large amount of nitrogen absorbed in the form of amino acids which cannot be utilized as such. This excess nitrogen is split off from the absorbed amino acids and at once turned over to the kidneys for excretion. An excessive protein diet, therefore, results in increased elimination of urea. The amount of nitrogen so excreted varies with the amount previously ingested and does not vary with work done.

The Utilization of Food

The foodstuff that is utilized in performing work is primarily carbohydrate and secondarily fat. Each of these substances can be oxidized and so furnish a large share of their energy content which may be transferred into the energy of work, or stored as body tissue. As we shall see later the diet for hard work should include

an increased amount of these substances rather than an increased amount of protein. In this connection, however, it should be explained how it is that work can be done on a protein diet although not so economically as on another kind of diet. The protein when it is changed into amino acids is a chemical compound containing carbon, hydrogen and oxygen (somewhat in the proportions in which these elements occur in carbohydrate) but also containing nitrogen. In the case of an excessive intake of protein, supplying more nitrogen than the body requires for its special nitrogen needs, it is true that the excess nitrogen is split off from the amino acids and sent to the kidneys, but in addition the residue from this splitting process, consisting of the elements which make up carbohydrates, is retained in the body and is eventually burned through oxidation, yielding energy just as the burning of regular carbohydrates yields energy. The protein in the form of amino acid may be thought of as a carbohydrate plus nitrogen. This picture is not exactly accurate but it is essentially the fact.

The reason carbohydrate is a more economical source of energy for work to be done is that the carbohydrate can be rendered completely useful for energy purposes by oxidation without any by-products to be considered, while the protein used for energy purpose must first be further split into useful carbohydrate and the residue of unnecessary nitrogen eliminated by the kidneys.

It has been repeatedly suggested by various authors that excess protein puts an undue load on the kidneys which must take care of the unnecessary amount of nitrogen. If putting the kidneys to this labor of excre-

tion is in the nature of a strain upon the kidney function, then it is obvious that such a practice is undesirable. There are other objections to a high protein diet which it seems to the authors are more serious. These considerations pertain to the condition in the small intestine before absorption and they will be treated of elsewhere in this book.

CHAPTER III

THE MOUTH

Keeping in mind what takes place in digestion and absorption, it appears that the hygiene of the digestive system deals with the processes of tearing apart mechanically and chemically the food which enters the mouth and with its subsequent absorption. A failure in any of these processes interferes with efficient digestion. The sound health and normal functioning of the oral structures is of such importance to digestion and to other phases of bodily health that the hygiene of the mouth may properly be considered at this point.

Three principal processes take place in the mouth. The food is disintegrated mechanically by mastication, it is moistened with saliva, and a certain amount of carbohydrate digestion may take place after the admixture of salivary secretions with the carbohydrate portions of the food.

Teeth

The teeth are used in the first of these processes. The teeth which first appear are temporary and should receive intelligent care. Care of the teeth can be taught the youngster, and it is during childhood that good habits may be formed most easily and most lastingly. The permanent shape and contours of the jaws are determined largely during this period of the milk teeth. Premature loss of one or more of the temporary teeth sets up new stresses and strains in the developing jaw structures which may cause malformations which tend

to become more pronounced as the child grows to adult life.

Evils of Tooth Decay

Teeth vary in hardness and in their ability to withstand decay, and the quality of the tooth function determines to a great degree the efficiency of digestion. Decayed teeth not only cause inconvenience to the possessor but also interfere with proper mastication. Even teeth which naturally are strong and resistive to decay require attention to keep them in a healthy condition. When teeth are not in proper condition so that mastication is interfered with, the stomach and intestine, in order to complete digestion, must, with their chemical equipment, make up for the work slighted in this, the first stage of the alimentation process. Among other evils which result from such a train of circumstances there is a prolongation of the length of time the food is actually within the alimentary tube before absorption can take place, thus affording a chance for bacterial action to change the character of the partially digested food, rendering it in part not fit for digestion and in part actually harmful to the system when absorbed.

Tooth decay is harmful besides causing the possessor of a decayed tooth to favor it by not chewing upon it, in that decay of tooth structure means an open portal of entry into the body tissue for bacteria which may themselves gain access to the blood stream or may excrete their poisonous products into the blood.

Sixth Year Molars

The first of the permanent set of teeth to appear are the sixth year molars. They can be easily identified. Starting in the middle of the upper or lower jaw, count

toward one side five teeth. The next one, if there be one, is a sixth year molar. They are sometimes thought to be the last of the temporary teeth and are often neglected. They seem to be more subject to decay than the later permanent teeth and it has been thought that because they appear in childhood before the diet becomes widely varied they may be of softer structure than the later teeth. It is more probable that the sixth year molars are often decayed because they are neglected.

Not all persons realize how important it is that the four sixth year molars be carefully guarded. They are really keys to the arches of permanent teeth. Others come in with definite relation to them as regards position. Moreover, if the temporary molars (the fifth, counting around from the middle) are allowed to decay and come out prematurely, then the sixth year molars tend to push forward into the space left. This means that there will not be room for the later front teeth to form in regular line. Again if the sixth year molars decay and come out before the remaining molars of the permanent set are in position, the second molars will come forward into the space left and the whole series of teeth in front of the sixth year molar will tend to drift backward. A common fault in teeth is a receding lower jaw, caused by the early decay and loss of the lower sixth year molar on one or both sides. This makes the biting position of the final front teeth inefficient, the upper front teeth coming down too far over the corresponding lower members. The upper lip is forced out and the lower lip is retracted. The appearance of the face is less presentable and the teeth cannot do their work so well.

The Nature of Decay

Tooth decay can be understood only if one is familiar with the structure of a tooth (Fig. 2). The healthy tooth has a hard shiny covering all over its exposed por-

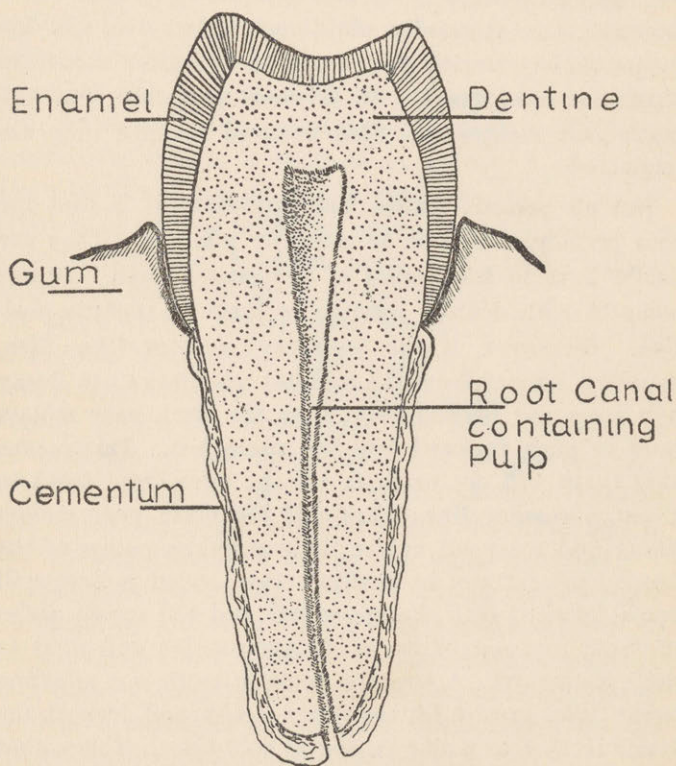


Fig. 2.—Diagram of tooth structure.

tion, an enamel that is laid over a slightly less hard but nevertheless firm substratum. The firm layer below the enamel is called dentine. At the center of the mass of dentine is a region filled with pulp in which are blood

vessels and a nerve. The enamel itself is resistant to decay. The dentine and the pulp may decay. So long as the enamel is smooth and whole, decay of the dentine cannot start.

A break in the enamel opens the way to tooth decay. This break may be brought about in one of two ways, either from a mechanical strain such as might come from biting something too hard and resistant, or by chemical action.

Acids tend to disintegrate the enamel if the contact between the two is maintained too long. Acids may be formed from the action of bacteria upon sugar. Bacteria are always more or less plentiful in the mouth. You will remember that saliva in contact with a carbohydrate forms sugar. Thus we have the stage set for acid formation if food be allowed to remain in the crevices between the teeth for a long time.

Prevention of Decay

In preventing tooth decay, therefore, one must avoid breaking the enamel by cracking nuts with the teeth or biting hard candy, and one must keep the teeth cleaned. After eating, brush the teeth to remove any particles of carbohydrate which may be lodged between the teeth or which may be sticking to the teeth. The brushing and cleansing may include the use of a tooth powder or paste which has antibacterial properties, or the actual cleansing action may be relied upon to reduce temporarily the number of bacteria present.

The longest period between meals is that between the evening meal and breakfast. The most important time to clean the teeth is, therefore, after the evening meal. It is convenient to leave this process until just

before retiring for the night and such a practice is quite satisfactory. Brushing the teeth on arising removes any mucous plaques which may have formed on the enamel during the night and is desirable. It also gives a clean taste of the mouth, which adds to the feeling of self-respect with which we should start the day. It may be inconvenient to brush the teeth after the noon meal and if proper care is given to the teeth at other times, noon time brushing is not necessary. However, it does no harm.

Dental Inspection

A tooth in which the enamel has been injured may have so small a crevice that it cannot at first easily be found. The dentist, however, can find such a break sooner than any one else and remedy the difficulty. For this reason it is highly desirable to have the teeth inspected by the dentist regularly. For those with well-nourished teeth, resistant to decay, once in six months is adequate for dental inspection. Such an inspection may take only a few minutes and certainly will involve nothing more than minor painless manipulations. For those who have softer teeth once in three months may be desirable to be sure that decay does not gain headway. Rarely can decay from acid formation gain much headway in inaccessible parts of the teeth in three months if regular brushing is a daily habit. In case of a cracking of the enamel through biting upon something hard, the dentist should inspect the condition at once.

Tartar

The deposit of hard material of a yellowish or dark color upon teeth is known as *tartar*. Tartar consists

largely of calcium salts which are precipitated from saliva under certain conditions. These conditions, curiously enough, are not the conditions which favor tooth decay, but exactly the opposite. All the body fluids are slightly alkaline as a rule, and this is true of the saliva. The reaction of the fluids which normally bathe the teeth is then alkaline and it is only when there is some abnormality, induced perhaps by indigestion, or brought about by bacterial action upon food which has not been removed from between the teeth that the normal fluids in the mouth are acid. Tartar is not deposited on the teeth when the fluids are acid or neutral in reaction. It is deposited on the teeth only when the saliva is alkaline. If for any reason the saliva is excessively alkaline, tartar deposits will increase.

It has been noted that the diet determines to some degree the deposits of tartar and that during the winter months there is more of such deposit than during the summer months. It has also been observed that eating firm textured fruits with a natural mildly acid juice tends to diminish tartar deposits. There is very likely a connection between these two facts. In the summer months apples, pears, berries, are part of the ordinary diet, while in the winter if these fruits are available they are not so plentiful.

It is a common slogan, carrying some grain of truth, that "an apple a day keeps the doctor away." Be that as it may, it is much more likely to be true that "an apple a day will keep tartar away." The apple has a firm flesh which is rubbed over the surfaces of the teeth in biting and mechanically scrubs them. An apple must be chewed to be enjoyed. A bite is taken by the front or incisor teeth and then the morsel is crushed by the molars. In the process of mastication of the fruit there

is liberated the mild organic acid which is typical of apples, called malic acid. This tends to reduce temporarily the alkalinity of the saliva with which it is mixed, especially at the surfaces of many teeth, but the acid is not strong enough nor permanent enough to cause a dissolving of the enamel. Thus, eating apples seems a beneficial thing for the teeth and not likely to cause harm to them. To be sure, if particles of apple lodge between the teeth there may ensue a local conversion of sugar to lactic acid, which might, in the spot where it is held concentrated, dissolve some of the enamel. But we must suppose that after eating apples or other food such particles will be removed.

Dislodgment of Food Particles

The teeth, if erupted from the gums normally and without loss of any one, should be aligned shoulder to shoulder as it were, each one touching its neighbor. In regular teeth there is little tendency for food to work down between adjacent teeth, but any slight irregularity may leave small spaces into which food can be crowded, from which it is dislodged only with effort. Who has not, after eating fruit at some time or other, fished around with the tongue industriously but more or less without result in trying to dislodge some shred that has lodged between the teeth? The correct and efficient way to remove such particles is to use dental floss, a strong, fine thread which can be slipped down between the teeth and worked backwards and forwards a few times. The precaution to be used in employing dental floss is to avoid sawing the tender gingival tissues which, at the junction of tooth with gum, are folded tightly about the exposed enamel. Injury to these tissues may be painful and has always the danger that it

makes a break in the healthy skin into which bacteria may make their way and grow. (Cf. Fig. 4.)

Pastes and Powders

If a tooth powder is used it should be one which is properly prepared with a base of precipitated chalk, fine grained and not sufficiently abrasive to scratch the shining enamel. Any good preparation which is pleasing in taste to the user, which cleans the teeth satisfactorily is a good one to use. The advice of one's dentist is usually the best to follow, because he may, from his knowledge of your particular mouth conditions, prescribe a dentifrice adapted to the particular situation. Tooth pastes which are widely advertised to accomplish a chemical or dissolving action of alleged harmful substances in the mouth are to be scrutinized with care. Ordinary salt and water with proper application of the toothbrush is often as satisfactory as an expensively marketed paste or powder. In fact, more importance is to be attached to the method of brushing than to the particular dentifrice employed.

Oral Cleansing

In brushing the teeth the obvious method of scrubbing back and forth across the front of the teeth is not adequate. The teeth should be cleansed with a motion of the brush designed to dislodge substances from between adjacent teeth. To accomplish this a tufted brush should be used. Whether the handle bends in or out is a matter perhaps of individual preference. The motion imparted to the toothbrush should be rotary, across the upper teeth and down to the lower set, then back again and over the same course several times. Then

the brush may be shifted to a new area and the process repeated, gradually working round to the other side of the mouth. (See Fig. 3.)

After the outer surface of the teeth has been well brushed, taking care to get the bristles down into the crevices between them, the inside of the teeth on the aspect toward the tongue should receive treatment. This can be accomplished best by using an in and out polishing motion, taking two teeth at a time, first covering the upper and then the lower set. Last, the grinding surfaces should be brushed to remove any deposits from

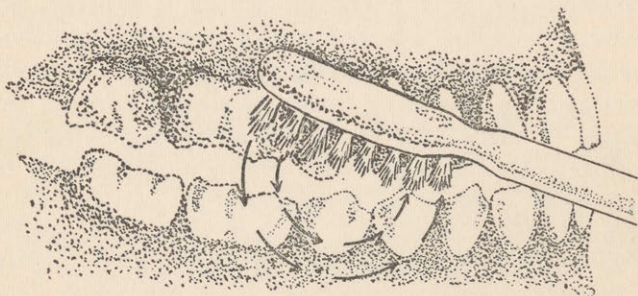


Fig. 3.—The correct manner of using the tooth brush.

the hollows and irregular surfaces. It is desirable also to brush the tongue and inside of the mouth lightly so as not to injure the delicate membranes but to remove any excess material deposited thereon. A final rinsing of the mouth with cold water is cleansing and invigorating. Fill the mouth with water and with the lips compressed "blow" the water out into the cheeks and then suck it back. This sends little streams through the spaces between the teeth and gives these important areas a final wash. It is to be remembered that the outer visible part of the teeth is not the part that needs

the most attention, but rather the surfaces that are in between and in behind where they do not show.

Care of Soft Tissues

A second result from brushing the teeth is the massage given to the tissues of the gums. This exercise of the gum tissues stimulates the circulation of the blood therein and improves their general tone. If the gums bleed when the teeth are brushed, it is not necessarily a sign of pyorrhea, although it may be. Tender gums may have sluggish blood circulation and tissues which are not in vigorous physical tone. Gentle brushing with a brush which is not too stiff, or even rubbing of the gums with a finger will improve this condition, and restore them eventually to a more healthy state in which bleeding will no longer follow brushing. If pyorrhea be present, the gums will continue to bleed and will gradually recede from the teeth unless skillful dental treatment is secured.

The gingival tissues which invest the tooth, if injured, open a portal of bacterial infection. This portal may result in the entry of other microorganisms if they be present and a state of infection result that may lead to subsequent decay. If such tissues be pulled away from the enamel, there is an added pocket formed for the lodgment of food with a good chance for the subsequent development of a spot of decay "under the gum." (See Fig. 4.)

Focal Infections

Decay of the tooth structure is known technically as dental caries. If the dentist is given an opportunity to treat this condition before the decay spot has spread far into the dentine he can remove the decayed portion

and fill up the clean hole with suitable filling. If, however, the decay is allowed to spread deeply into the dentine, it will eventually, if not checked, reach the pulp in which is located the nerve. The nerve exposed

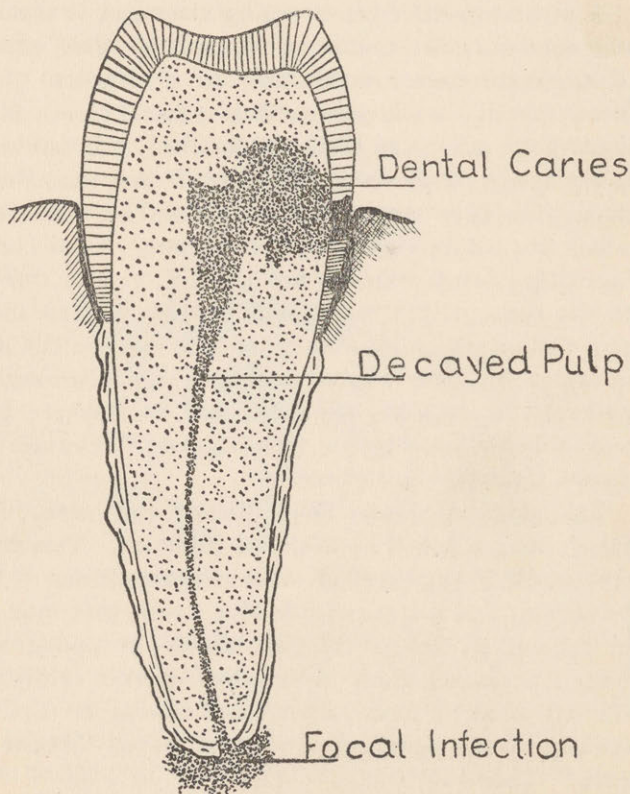


Fig. 4.—Dental caries and focal infection.

to the air and to hot or cold food will begin to "hurt." Such a tooth is more difficult to restore, but if the decay has not been too extensive a skillful dentist can still save it. When, however, the decay has got into

the pulp so far as to destroy the living tissue around the nerve, then the nerve will begin to die and itself become food for the invading bacteria. Eventually such infection may travel down through the root canal and a spot of infection becomes established at the base of the root outside the tooth deep in the gum. Such a state constitutes a focal infection.

The continued growth of bacteria in one focus or spot results in the formation of chemically diffusible substances from the bacteria which are poisonous to the human system. If the condition persists, a widening area of infection may ensue until finally the bacteria get into the blood stream and travel around the body in the blood. This in itself is not so bad as another result which sooner or later follows, namely, the lodgement of some of these bacteria on the inside surface of the heart or other portions of the body where a new focus of infection may be established. When an infection passes through the root canal and becomes established below the tooth in the tissues which surround the root, there is usually only one remedy, the extraction of the tooth so that the infection can be cleaned out.

The outer appearance of a tooth which has hard enamel is sometimes deceiving to casual inspection, because a minute break in the enamel, too small to be visible to the eye, may, nevertheless, have been large enough to let in bacteria to the dentine. Decay may have started under the enamel and have created a cavity in the dentine not visible from the outside. It should be obvious when one thinks about the matter in the light of the above facts that the only sensible thing to do is visit the dentist regularly. Such a course is the only sure guarantee of painless dentistry. Prevention is the watchword of mouth hygiene.

CHAPTER IV

THE ALIMENTARY TRACT

Considerable attention has been paid the hygiene of the mouth, more attention than would seem to be warranted when we consider what a relatively small part of the entire process of digestion is carried on in the mouth. The importance of the health of the mouth and its structures to healthy living is quite largely because the mouth is really "outside" the body. By that we mean that the lining of the mouth is in direct communication with the outside environment and is a covering for the tissues immediately below it.

Because the mouth cavity is in direct communication with the outside, all sorts of things get into the mouth, air, food and water, too often fingers, penholders, pencils, not to mention various and sundry odd articles which, in moments of abstraction, we may "chew." The mouth, then, is constantly subjected to additions of germs or bacteria. Most of these are harmless. Others are harmless only so long as they are *outside* the body.

If there is a break in the coverings of the body tissues anywhere, such, as for instance, a decayed tooth or an injured membrane, that break constitutes a break in our defenses. It is as a possible point of entry for these invisible enemies that the mouth needs greatest attention in so far as its hygiene is concerned. The part played by the healthy mouth in the process of digesting food is, however, not negligible. It is here that digestion starts in the presence of saliva.

There is a function of salivary digestion which as yet has not been mentioned. It is an indirect function and involves a chain of events, to understand which the reader must first understand the facts covered in the chapter on the nervous system. Briefly stated, saliva thoroughly mixed with food brings out flavors that otherwise would not be detected. These flavors in general are sweetish and pleasing. They whet the appetite. Besides arousing pleasurable sensations they cause, indirectly, through the mechanism of the nerve communications system, a flow of gastric juice in preparation for the food which has aroused these sensations of pleasure. In this manner gastric juice is secreted before the food arrives at the stomach as well as after its arrival, and digestion in the stomach is thereby speeded up.

Psychic Secretion

The flow of gastric juice from the walls of the stomach into the cavity thereof is influenced largely by the nervous system. Pleasurable anticipation of eating, aroused by the odor of well-cooked food, or even by the thought of particularly delicious viands makes the digestive juices pour out in anticipation of the arrival of food. When one is hungry, or, for that matter, at almost any time except on such occasions as arising from the Thanksgiving dinner or a particularly heavy feast, one can, by thinking of the most delicious foods, cause the mouth to "water." All that is necessary is to think of the particular food that you like best, be it a juicy, tender steak, sending off its rich aroma to gladden the sense of smell, and delighting the eye with its shades of brown, not forgetting the mushrooms which almost smother it, the whole on a silver platter garnished with

a bit of green; or be it a pair of little golden brown birds on an island of caramel colored toast, garnished with bits of this and that; or be it a good old-fashioned hot baked potato, a slice of ham, and fried eggs; according to the taste and the occasion, the thought of some of these edibles will make some one's mouth water. How about yourself right now? Are you swallowing? Has your tongue automatically run over your lips?

Why the Mouth "Waters"

This watering of the mouth under mental stimulus is an involuntary nerve reaction. As a result of certain trains of thought there have been nerve messages dispatched to the glands of the mouth which secrete saliva. Similar messages have stimulated the glands of the stomach to secrete their digestive juice. But notice from your own experience from time to time the nature of the sensations which result in flow of saliva in this fashion. They will always be pleasurable sensations. What may be a pleasurable stimulation to one is not so to another. The Teutonic peoples in general have the reputation of enjoying as an article of diet certain cheeses that to the Anglo Saxon in general are offensive in odor. To him who likes Limburger cheese the thought of it with the proper attendant viands is calculated to make his mouth water. To him who knows only the outrageous smell of the cheese, no amount of food or beverage can make the thought of consuming the cheese attractive, and such a thought will stimulate neither the flow of saliva nor of gastric juice.

Any one who has had the misfortune to be stranded in a strange city in the summer time, forced to seek his daily calories in restaurants, has known the sensation of

being served with what he has listlessly ordered, of feeling that he has after all no desire for food. The surroundings, the service, the previous occupation, the general hygiene (or its lack), one thing or another or a combination of all, has served to take away his appetite. Does the mouth water then? Of course not. If under such unfavorable conditions, one eats from a sense of duty or economy, the process is at first like stuffing food into a pocket. It is not easy to start to eat, and if the food is finally crammed down, it is not started properly on its way to digestion. There is a way, however, to alleviate such conditions. It is perhaps especially important that those who are living in institutions where the table is apt to become monotonous should know the best way of meeting such situations.

Fletcherism

The best remedy for indigestion is always to prevent it. The story of Horace Fletcher illustrates what one can accomplish in this line. Horace Fletcher at middle age was considered by life insurance companies a bad risk. He was thought to be the victim of incurable organic troubles; he was overweight, it was said that he could not hope to survive long. One summer when friends were away he sat down to dinner entirely without appetite alone in a hotel dining room. The first course was served and he eyed it without enthusiasm. The habit of eating is strong, however, and he did even as any one else in the same circumstances, he toyed a bit with the soup, eventually tasting it. With nothing to do it was obviously the ordinary procedure to prolong the business of eating, poor occupation though it seemed. He was not interested to swallow the soup he

had taken into his mouth, but allowed it to roll around a bit, playing with it idly with his tongue. How many thousands in the same situation have done likewise! A spark of interest was aroused by a transient flavor, the process was repeated as interest was weakly kindled. He took another taste and searched for that fleeting flavor.

To search for a flavor one does not gobble, one rolls the food about in the mouth with the tongue. Fletcher did this and discovered that by so doing he could find flavors that he otherwise missed. It became for the moment an interesting business, relieving the dullness of inertia. What would work with soup should give results with solid food, and he searched the other courses in like manner as they were served. Thus did one man accidentally discover that eating can be made a game of discovery, an innocent pastime to while away dull moments. He arose from what started out to be an unappetizing necessity, refreshed and interested.

He thought it over. He tried it again. Eventually for himself he worked out a system of eating that has become widely known under the name of Fletcherism. From a sick man he became a most vigorous individual, not entirely because of his method of eating, but with that as a starting point, because of his revised methods of living. He studied hygiene and practiced it. At Yale some years later he underwent the same tests for physical efficiency that the trained college athletes took to test their strength and endurance. Under the same conditions he made a record for strength and endurance that had never been equalled at that institution, and he did it not once but repeatedly.

Fletcher has been widely misquoted and there is a current idea concerning the nature of Fletcherism that

is not founded on fact. One often hears that this system means chewing each mouthful of everything, soup included, thirty times before swallowing it. Fletcher advocated nothing of the sort. His method is to taste thoroughly everything that is eaten. By discovering the flavors ordinarily missed in hasty eating, there is a new pleasure in eating. Pleasurable sensations automatically release the flow of digestive juices. In tasting things, they are held in the mouth for a moment or two longer than otherwise and so become mixed with saliva as they should be for good digestion. Solid foods are chewed to release their flavors and in the process are torn apart as nature intends they should be before they are swallowed. The brief time for holding the food in the mouth to get at its taste allows time for gastric juice to be secreted ready for the arrival of the bolus in the stomach. All these factors, therefore, simply make available the functions of digestion in their normal condition and the inevitable result is that digestion takes place.

Another thing that can be done in connection with this system of rational eating is to supply the body with the necessary fluids in the form of water taken as such or in food containing water so that the processes of absorption and diffusion through the body membranes can take place readily. Another thing that Fletcher found was worth while in connection with his system is that by tasting thoroughly the food eaten, one result is that one is satisfied with less amount than otherwise. The reason for this is scientific. By properly digesting what we do eat and digesting all the digestible part of the food, there is little or no undigested residue. What we eat becomes available for absorption, which, after all, is the ultimate goal of digestion. Food that is

eaten under such conditions that it becomes difficult for the body mechanisms to render it suitable for absorption is of no more value to us than food in the pocket. It is destined to become waste material and to be passed through the intestines in the feces.

Sensible Eating

The lesson learned by Fletcher is a lesson which should be valuable to all. Sensible eating is worth trying. To any one who tries it intelligently, not with mental reservations that amount to derision, but with an open mind, observing honestly and impartially the following simple rules until satisfied that a fair trial has been given the experiment, it should be worth while.

Taste everything thoroughly. Do not swallow anything until you are sure you have all the fleeting flavors extracted. If you cannot at first bring yourself to do this for a whole sitting, at least try it for the first few tastes of each thing you eat. Try it with water, it has taste, search for it.

Water

Drink plenty of water during the day and as much as you wish at meal times so long as you do not take water into the mouth while food is still unswallowed. Do not force yourself to drink water at meal times, but drink as much or as little as appetite or fancy dictates. Have the water cold enough to be refreshing. It is not necessary to have water exceedingly cold even in hot weather. Cool water is quite as refreshing as melted ice, and usually more so.

Choice of Food

Eat only enough to satisfy your hunger. Do not leave the table hungry unless there is some particular reason

to do so. Be temperate, however, and avoid stuffing when eating is fun. If you eat as slowly as is necessary to get at the tastes in your food, the quantity consumed will be automatically reduced. Eventually if the practice is continued, your appetite is a safe guide as regards the amount to be eaten at a time.

Choose the things you eat in so far as you may exercise this choice according to your own desire, after you have gained an understanding of the principles of nutrition and know what in general constitutes an adequate diet. If you find you must live on what is furnished you by some one else rather than on what you would yourself choose, then remember that it is even more necessary to make an exploration out of the business of eating, working up an interest in what possible delectable flavors may be hidden in what you have always regarded as not especially attractive.

Eating Habits

It is quite easy to form habits of eating which are sound hygienically, and when such habits are once well established, one can then forget the whole matter.

There are other factors than the method of eating and the mental attitude toward eating that make or mar the enjoyment of a meal. A meal should be *enjoyed*. There is nothing indelicate or selfish in enjoyment of food. One can keep this enjoyment largely to himself or share it circumspectly with table companions, and at the same time observe the conventions of the well bred in matters of dining.

These same conventions of the dinner have as their basis consideration of the feelings of one's fellows. To make sounds or motions which attract the attention of

others at the same board does not usually please one's fellow boarders. Anything which offends the sensibilities of one's fellows at meal times detracts from their sum of enjoyment of the occasion and in some measure results in a corresponding interference with the normal digestion which is as necessary for one individual as for any other. Gross indifference to this fact is responsible for offensive table manners. Breaches of etiquette are important only as they may react on some one else in the manner suggested. Whether one eats this or that with the incorrect fork or spoon is disturbing to a few, but usually if noticed at all, arouses a feeling of pleasant superiority in the mind of the beholder which in no way detracts from the physiologic efficiency of his digestive process. A sad or sour face, however, is depressing to all beholders. Likewise any manifestation of selfish disregard for others at meal times is very likely to react unfavorably as to the contentment of the observer.

Mental State

The recognition of the effect of the mental condition upon the matter of digestion is the basis for snowy linen, shining silver, soft lighting, and table decorations. What pleases any sense reacts favorably in building up the general feeling of well being. Pleasant table companions at meal times react in the same favorable way. The manner of cooking food and of serving it with due regard to pleasing appearance, therefore, has its real value. These facts are especially important for the sick whose appetite for food is capricious. Music at meal times is good for those who like it.

The nurse on duty has to take what comes. She will meet a variety of conditions at meal times. In a hos-

pital there is the tendency to monotony of diet that always creeps into institutional service. In the various homes which she enters she will meet conditions of varying degrees of family distress and irregularities in the normal routine of meals which are inevitable where there is sickness. It should be a great help to such persons as meet this sort of thing to see to it that when off duty due attention is given to securing meals attractively served, appetizingly cooked, amidst well-ordered, pleasing surroundings with agreeable companionship at meal times. These occasions will be remembered and will be looked forward to during the times of professional stress. The psychologic effect is the same as that which comes to him who in working clothes has the realization of a complete wardrobe at home to be donned whenever occasion arises. An old coat galls only him who has no other. A cold lunch is of no moment to the well fed.

Intestinal Digestion

As to digestion in the small intestine, little control can be exercised by the individual beyond taking precautions to see that the right sort of food is given the proper introduction to the alimentary canal in the manner already indicated. The only regulation over the absorption processes available to us is to see that the body fluids are plentiful and that by taking sufficient water these fluids are kept changed with reasonable frequency. By proper exercise, as will be pointed out in another place, we can assure ourselves that these body fluids are free to move about in their own way according to the plan of nature. All this takes care of itself in health.

Constipation

In the matter of elimination of undigested residues, we come to a much more difficult problem. The present conditions of civilized life have resulted in an unfortunate general tendency to constipation. It would be futile to try to catalogue the whole train of unfavorable results attendant upon constipation, and impossible to estimate how large a proportion of the population in general are subject to these unfavorable conditions.

The activating causes of constipation are numerous, but may be summed up as conditions of improper living or improper eating. Of these two groups it is difficult to tell which is the more important. Both need correction if this condition is present. Certainly results tending to alleviate the ordinary degree of constipation can be accomplished by attention to what to eat, when to eat, how to eat, and where to eat. The question of what to eat will be discussed under the head of nutrition. The other points have been mentioned. By eating properly for health, tasting thoroughly and chewing adequately, the amount of undigested food residues will be greatly reduced. Drinking plenty of water is helpful in keeping the contents of the intestine fluid, so that the tendency for the feces to become dry and impacted is lessened.

Peristalsis

The mental condition plays a part here as well as in influencing digestion. The material in the intestine is moved along toward the anal orifice by waves of muscular contraction of the intestine itself. This phenomenon of a wave of contraction preceded by a wave of relaxation of the intestinal wall results in the contents being pushed along in small masses toward the lower

end. It is known as peristalsis. It is brought about by automatic nerve regulation of the muscles involved. Anything that interferes with the regular and orderly sequence of nerve impulses results in interference with peristalsis. Such an interference is brought about when the mental state is one of depression or worry or fear or anger. These emotions involve the interplay of nerve impulses. These unfavorable nerve impulses tend to obstruct the nerve paths, blocking to some degree the normal flow of nerve messages. In worry and kindred emotional states peristalsis is slowed down and may even be stopped. If this condition is continued, it is as if the body had forgotten that these impulses are necessary. The condition of stasis or intestinal quiet ensues. With no propulsive forces to move along the wastes, there is no evacuation of the feces. This state is that of constipation.

Laxatives and Cathartics

The various drugs used commonly to combat this sluggish action of the intestines are well known to most persons. They are the laxatives and cathartics. Their exact physiologic action is not entirely clear. These drugs are palliatives and not remedies. After their use, if old habits of improper eating, lack of exercise, and unhealthy mental state are persisted in, the condition comes back inexorably. Fibrous vegetables, ripe fruits, and plenty of water are the natural means of preventing constipation.

Posture and Digestion

Improper posture, the manner of holding the body in a slumped position rather than erect, also contributes to hinder the passage of wastes along the intestine. A

body in incorrect posture allows the stomach to press down on the coils of the intestine and allows the intestine to sag. This interferes with proper blood supply to the parts involved and consequently they are not in a vigorous state of health. The firmness of the muscles is lost to some extent. Instead of a vigorous responsive musculature of the intestinal walls, we have weak, flabby muscles which, when stimulated to contract, do so weakly and ineffectually, like a fat, flabby individual trying to engage in strenuous work.

Regularity in Bowel Habits

Repression of the natural desire for defecation because of temporary interference of duties or because of inertia results unfavorably. Such repression of the natural urge soon results in its disappearance and begins a temporary condition of constipation which, if persisted in, rapidly becomes a chronic condition. Regularity of defecation at regular times should become a habit that is normal. Interference with this regularity is always undesirable. Especially in children is it advisable to have a regular time for emptying the bowel. In the morning, after breakfast is a desirable time. The intestinal tract is stimulated to activity along its whole length by the presence of food. The activity of the day after the night's rest starts up all the physiologic processes into renewed activity and peristalsis is among the activities so stimulated.

Drinking water immediately on arising before breakfast is also extremely beneficial in this regard. The water may be hot or cold, according to one's preference, but either hot or cold is better than lukewarm. Hot water draws blood to the stomach and acts like food in

some degree in creating stimuli further down the intestine. Cold water acts temporarily as a tonic to the stomach muscles and there may be assumed to be a reaction also, drawing blood to these areas. Water in the morning on an empty stomach (which is not really empty as we shall see) tends to leave the stomach, washing it out and removing any old fluids which have remained there or gathered there during the night, and stimulating the intestine as it is passed on.

The lower animals in wild state have no such inhibitions of delicacy as operate in the life of civilized man. These animals respond to the urge of nature for ridding themselves of useless wastes and so far as is known are not subject to constipation. Their habits of living and eating are normal, according to their species, so that the other causes of constipation in mankind are not operative in the lower animals. It is not suggested that mankind return to the ways of the beasts in any respect, but we can learn from study of their lives the value of regularity and response to natural stimuli of all kinds, suitably controlled and ordered by intelligence and the exigencies of civilization.

What is to be considered a normal evacuation habit varies with the individual. It varies with the amount of undigested food residues, which in turn vary with the nature and amount of digested food. With some individuals it may be that an evacuation once in two days or even twice a week will keep the intestines free from undue accumulation of wastes, while with others twice a day may be necessary to get rid of these undigested residues, but the average habit seems to be once a day and at the same time each day in the nonconstipated. Any departure from the regularity of evacuation of the bowels shows that something is wrong. The thing to

do is to find out what is wrong and correct the condition, not resort to artificial methods of removing the accumulations except temporarily, if so advised by your physician. The indiscriminate use of cathartics and laxatives by the public is an unsound practice.

Constriction of the viscera by improperly tight clothing is not so general as it was once upon a time. Improper corseting by constriction or by displacement of the viscera is always, however, a possible contributing cause to an abnormal lack of intestinal function and is, of course, to be avoided.

So long as food is taken into the body, so long will wastes be accumulated, and the necessity for their removal is obvious. If attention is to be limited to any one particular point of hygiene, it might be well focused on prevention of constipation for in so doing one is led to practice all the other measures of personal hygiene which taken together bring health. An attitude more worth while is, however, to seek out the ways of maintaining health, the normal functioning of the whole, since when this is attained, each function contributing to the health is automatically taken care of.

The kind of food has an important bearing on this condition and will be taken up under the subject of Nutrition. Exercise also has an important effect as will be pointed out elsewhere. Likewise, the direct effect of posture will become evident as the study of that subject is undertaken. The occurrence of constipation is a well-known attendant symptom in those whose nervous system is not functioning smoothly, the so-called neurasthenic being an extreme example of this condition. This matter also will be taken up in the appropriate chapter.

CHAPTER V

THE NERVOUS SYSTEM

Arrangement and Function of Nerves

The nervous system can be likened to a great system of communications. The nerves are bundles of special fibers and correspond to the cables containing many telephone or telegraph wires of our commercial systems of communication. Just as in the case of the telephone, one cable carries many wires, each with a separate destination, so with the nerve bundle, each of its fibers has a separate destination. A telephone cable carrying lines to one section of a city runs from a central station over a given course. All the wires are bunched together until the particular section to be served is reached, then the wires separately connect each with its own instrument.

Many such cables may be laid side by side in a conduit through the first stage of the journey. There is a similar arrangement in the nervous system of communications between various parts of the body. The brain is the great central station. From it bundles of fibers run down the spinal cord. At various substations branches are given off, each branch, called a nerve, containing many individual nerve fibers each of which connects separately and individually at its termination with some body cell. At these body cells the messages are received.

Again using the same simile, no telephoned message is ever received unless somewhere it has been trans-

mitted, or put onto the line. There is a start for every nerve impulse. Some nerve impulses, or messages, whichever we choose to call them, are between different subscribers to the same system. A cell in the nasal mucosa is stimulated by the odor of cake cooking in the oven. It sends a message through the central station of the brain which is switched over to the lines terminating in the salivary glands and the gastric glands, both at the same time perhaps. The message on arriving automatically causes the cells which receive the message to secrete digestive juices.

If worry or other strong emotion is present, all the outgoing lines from central are occupied, and just as one cannot get two telephone messages over one line at the same time, it is equally difficult to send a nerve message over a line that is in use. There is this difference, however. In case of two nerve impulses sent out to the same line, the stronger one overcomes the weaker. Intense delight takes precedence over fretful dissatisfaction, the need for sudden action when danger threatens has its response in nerve impulses sent to the muscles while ordinary messages are held up. One message at a time is the universal rule over the lines of the nerve connections.

Every nerve impulse originates from outside the body. In the case of the use of the will, when we decide to do something, this fact is not obvious, but actually we decide to do things only in the light of intelligence. Intelligence is built on experience. Experience comes from contact with the outside world.

Sensory Stimuli

Do we see an accident? Rays of light have come from some outside object to the eye; they have stimulated

the receptor ends of nerve fibers located in the retina. The impulse goes to the brain, where it is switched about, and in the light of past experience we "decide" what to do. If there had been no past experience, we should not know how to interpret what we see and would not know what to do. Children sometimes seem heartless or unsympathetic. They have had no experience to enable them to recognize the particular type of suffering of which they become conscious.

The Autonomic System

In addition to the connections in the nervous system between the brain or spinal cord and the cells of the body, there is another system more or less connected to central which works without the brain. Its action is automatic, like the automatic telephone which makes connection without the aid of a central operator. This second division of the nervous system is the so-called autonomic or sympathetic system. The principal system having its origin in the brain or spinal cord is appropriately called the central nervous system. Because the two systems are connected, a strong surge of impulses in one may work over into the other.

Effectors

At the end of each nerve line there is a mechanism corresponding to the telephone instrument which is known as an effector. A telephone line transmits messages in either direction, even in both directions at once. A nerve line transmits always only in one direction. Any reply message has to travel over a return line. The effector at the terminal end of the line changes the nerve impulse into some other kind of energy, and work is

done such as the secretion from a gland or the contraction of a muscle. The mechanism at the beginning end of a line takes some form of energy and turns it into a nerve impulse. In a given area of the body there are usually two sets of nerve connections, one to bring impulses to that region of the body and the other to transmit messages from that area.

Receptors

In the walls of the intestine there are cells called receptor cells which receive stimuli from contact with substances in the intestine. These stimuli translated into nerve impulses are sent to the local automatic central and are switched over without aid of the brain onto return lines which terminate in muscle fibers of the same region of the intestine or a nearby region. As a result, these muscle fibers are caused to contract and the food is thereby squeezed along. It then stimulates new receptors farther down, the same process is automatically repeated and a second contraction takes place, moving the food still further along. This is peristalsis.

If some strong emotion holds sway, such as anger or fear, the messages incident to this emotion are flooding all the lines. There is no chance for the normal call and answer, and as a result peristalsis cannot take place. The calls for action are there in the receptor ends of the nerves of the intestine, but they cannot get started as nerve impulses. Since they cannot get started, there can be no reply.

Take another case, where the intestinal content is entirely fluid ^{or} has been moved along after digestion, there is then nothing to stimulate the receptors and, of course, no message goes out. When none goes out there

can be no reply. In a third case where the intestine is packed with wastes and the urge to defecate has been denied, there have been frantic messages for a time with equally strong replies in the nature of muscular contraction, but since these have been opposed by impulses instigated by the will, some link in the chain of communications apparently tires and gives up the job temporarily.

The Nerve a Living Cell

The nerve fibers are living individual cells. Each has a point of origin with a nucleus and from this central point a long process grows out which may be several feet in length or only a few millimeters long. The living fiber maintains its life and its ability to transmit nerve impulses only so long as the life of the entire nerve cell is maintained.

If the fiber is cut, the end separated from the nucleus degenerates and cannot be restored. In time the stub may grow out over the old course and form a new attachment, but until that happens, the line is out of order. In cases of diseases like poliomyelitis, there may result some injury to nerve fibers resulting in the death of the whole or parts of nerves. The result is that when bundles of these fibers are put out of order, nerve impulses to the muscles of a given area cannot get through. If there is a break near the delivery end of the line, paralysis ensues. This muscular paralysis will persist until the destroyed connections are regenerated. If the break is somewhere in an early relay, leaving the last link intact, then it may be possible to establish around the broken connection, new routes of communication between brain and muscle. Some of the effects of nerve injuries are more easily overcome than others.

Each function of the body is governed by nerve impulses. The heart beat, muscular movements in general, the chemistry of digestion and of the secretions, all are controlled through nerve stimuli. Moreover the various parts of the body keep in touch with each other through this system of communications. A disarrangement of normal function in one organ is reflected in disarrangement elsewhere. The smooth running of the whole mechanism in health depends upon the smooth functioning of each and every part of it.

The mentality involves the use of the nervous system. In exercising our mental power there are transmitted from one part of the brain to another various nerve messages, and in every volitional act messages leave the brain for a destination in some other part of the body. Emotions involve a transmission of nerve impulses, and when emotions become strong these impulses may flood the whole nerve system or at least such parts of this system that blockades occur preventing the transmission of the routine messages of the business of life.

Emotions

Two emotions have been especially studied in relation to their effect on the ordinary function of the nervous system and the normal regulation of body processes. These emotions are fear and anger. When either of these emotions gains sway, there is among other results, a stimulation of certain glands. Under such stimulation the adrenal glands secrete into the blood a substance, adrenalin, which exerts a profound effect on the course of the blood, and upon bodily chemistry.

An excess of adrenalin in the blood affects the vasomotor center and results in a diversion of blood from

the visceral region to the region of the skeletal muscles. At the same time the liver, which normally is a store house for animal starch, is compelled to yield up unusual amounts of this animal starch in the form of sugar. This sugar is carried by the blood to the region which is temporarily receiving most service from the blood, namely, the skeletal muscles. Sugar is fuel for muscle work, and its value in this place at times of fear or anger must be obvious. It is there ready to be burned to enable us to run or fight suddenly and powerfully with our muscles. The old adage, paraphrased, to the effect that he who fought or ran away, lived to have offspring, expresses a fact of evolution. Our ancestors developed the power of sudden muscular action in times of danger, else they would not have lived long enough to make our own personal existence possible.

Under conditions of strong fear or anger, the digestive processes are slowed or stopped. The nervous system seethes with impulses from our sensory equipment to the brain and with answering messages to the muscles. Everything is set for preservation from the cause of the emotion. One is physically keyed up and mentally alert, and if fear be strong enough, he may be able to perform muscular feats which ordinarily would be impossible. Meanwhile the ordinary internal communications are partially or completely paralyzed. In less strong states of these emotions the same effects are present though in less degree. Fretting and good digestion, therefore, are incompatible.

Habit Formation

The way in which intelligence can be utilized in the service of health through the nervous system is well

exemplified in the formation of habits. The given connections to a possible effector may be great in number. Which connections and which routes shall be employed to bring about a desired result is at times a seeming matter of chance or choice. By training and intelligence we come to use certain routes which prove most effective. After repeated use of certain connections for definite purposes the reaction becomes standardized or habitual. Habits once formed are notoriously hard to change.

Cheerful Philosophy

The mental attitude toward difficulties and unpleasant happenings is one habit reaction. Some persons worry over trifles. Others welcome difficulties as spurs to achievement. Some are pessimists—others are optimists. It is current belief that the pessimist is such because of lack of health and that the optimist is untroubled mentally because he is physically fit. Mental life and physical life do go hand in hand. One affects the other. Lack of health may cause lack of optimism, but on the other hand, lack of optimism has an undoubted physiologic result that is not favorable. One cannot cure a broken bone by smiling, but one can ward off indigestion by maintaining cheerfulness. It is the inner state of mind not the outward set of the features that counts, but it is hard to grin and keep on grinning without having the mind get in step to some extent with the pretense of cheer. Things annoy us only as we let them. If misfortune comes to us, it has no effect until we know about it and allow ourselves to think about it. Ailments can be fostered by attention and they can certainly be mitigated by attention to something else.

In consideration of the effect of mind upon health one

must keep constantly before him the fact that the relation is a reversible one. The body affects the mind and the mind affects the body. The real benefit derived by some persons from following the principles of mental healing, new thought, and the like, is perhaps due to the positive constructive emphasis placed by these cults upon cheerful thinking. In peace or war it is an advantage to be able to go over the top with a grin.

Worry

To anticipate the future is futile. That, however, is the basis of worry. It is not so much what has happened that worries us as it is the imagination of what may in the future happen as the result of what is past. To suspect each glass of milk of harboring germs, to shudder at every sneeze for fear that germs will again "get you if you don't watch out," to refrain from fun for fear of overdoing—those things take the joy out of life.

Worry must be banished indirectly. It must be crowded out. When something happens that calls for remedial measures, take thought as to what can be done constructively, and having decided that something can be done, do it and then forget it. Or, having decided that nothing can be done, be logical, what then is the use of worrying?

The Soldier's Creed

One creed of the doughboy is known to many. It runs something as follows:

"One of two things is certain, either I shall go to war or I shan't. If I don't, then there is nothing to worry about. If I do, one of two things is certain, either I shall go to the front or I shan't. If I don't, there is no

need to worry. If I do, one of two things is certain, either I shall be wounded or I shan't. If I am not wounded, there is no need to worry (for no one fears death itself). If I am wounded, one of two things is certain, I shall recover or I shall not. If I do recover, then there is nothing to worry about; if I don't recover then it is all right, there will be no more chance to worry."

The philosophic acceptance of what comes precludes worry over what may happen, and undoubtedly has a beneficial physiologic reaction.

Another way to circumvent undesirable states of mind is to "put up a front." Assume the appearance of cheerfulness and a carefree state. Do what you would do if you were carefree and happy, and in spite of yourself you will begin to feel a reflection of the mood you are simulating. Who has not seen a child work itself into a rage through the simulation of that which it at first vaguely feels until at last it is thoroughly permeated with the emotion of anger? And how soon a storm blows over with the child who has its attention diverted to something it especially enjoys. Frowns and tears disappear as by magic, joy and laughter take their place. Unseen but not the less actual is a physiologic response. We are all children more or less grown up.

Mind and Health

Two strong emotions cannot occupy the mind and monopolize the nervous system at the same time. Joy and anger or romantic passion and hunger are incompatibles. One cannot even think of two things at the same time. Thought occupies nerve channels to some extent. We all have a one-track mind. If you would

banish worry or fear or anger, think of something else. Think of something which compels the interested attention. If you can succeed in switching the thought, you have accomplished the result of banishing the unfavorable thought.

Hobbies

The value of a hobby, something that you are eager to turn to at each little opportunity, something which you relinquish even for a short time with regret, lies in the fact that it furnishes something which can easily be called up to occupy the mind. Be it gardening, athletics, chess, cooking or Mah Jongg, it matters little physiologically so long as you are eagerly interested. While you are riding your hobby your mental processes yield you pleasurable sensations, for if it did not the hobby would not be attractive.

Forget Symptoms

The exception to this rule, perhaps, is the individual who enjoys his symptoms. To be called abnormal is usually resented, but to be regarded as different used to be considered by some as interesting. For a few who know no better, it is privately regarded as the only way to stand out from the common herd and gain notoriety, and every one in some little degree wants to be prominent. Playing up ailments is therefore resorted to. It is doubtful whether any one really enjoys his ailments but many seem to enjoy talking about them. The worse they can be made out, the better.

The trouble with this kind of hobby is that it sets one to noticing the little ailments to which we all fall heir at one time or another. Talking about symptoms leads to

thinking about them, and what otherwise would be forgotten in real interests of a wholesome or useful nature looms larger and larger. To the nervous system waiting in hushed and enraptured expectancy for a symptom, even a little discomfort appears to the sensory apparatus like something tremendous. A book dropped from a table in a hushed room sounds noisy while the same book dropped on the floor of a busy office would make so little noise as not to be noticed.

Why is it that the physically fit sleep so well and wake up at a noise only to fall asleep again and forget it, while the poor person with "nerves," wakened by the same noise broods on it, thereby losing some moments of sleep, and next morning is sure she didn't sleep a wink all night? It is the mental attitude and the physical state each reacting one upon the other.

The remedy for nervousness is to occupy the mind with something that is attractive and pleasant. This does not mean to smirk and deny the existence of pain, but to really find something that is interesting. If one has not developed any hobby that demands attention, let him set about to do so. It may be hard at first, but the reward to the persistent is sure. What is it that we like to do? All of us like to do that which we can do well, preferably a little better than the other fellow at least some of the time. It is the contest that makes a game, and it is delight in mastering difficulties that gives satisfaction to expertness.

Who is an expert? Literally, one who has tried it out. If one will tackle any subject that is within his mental powers and study all about it, get newspaper comment, textbook lore, gather together the experience of others, or better yet explore on his own account, there comes a time when he has learned so much about

his subject that he knows more about it than his neighbor, then more about it than any of his acquaintances, at last more about it than anyone else he has ever heard of. These are all degrees of expertness. The first degree is a starting point of interest. Further pursuit of any subject always has the added interest of new fields to conquer, new difficulties to overcome. It is the joy of combat which is so marked in some races whose menfolk delight in a "shindy." It is the joy of achievement against odds which is the highest type of personal gratification.

"Stealing candy from a kid," is a popular expression of contempt of puny efforts or a reward won without difficulties overcome, while the robbing of a mail train, reprehensible though it is admitted to be, nevertheless commands a secret spark of admiration in many a law abiding citizen. Joy of achievement comes only from difficulties overcome.

"Not the quarry but the chase
Not the laurel but the race."

The nerves of the neurotic are generally all right, it is the occupation to which they are devoted that is all wrong. Even the healthy person may at times, as the result of physical fatigue, feel the depression of nervousness. This feeling ought to be removed by rest. If not it is apt to gradually increase. The physical cause should be sought and removed. Especial attention must be given to fun and relaxation from regular routine.

Instincts

Certain fundamental tendencies of mankind to react in definite ways to definite classes of stimuli we call instincts. Motor responses are a result of instinctive reply

to these stimuli. Instinct leads to purposeful action. This action is aided by emotion. Emotion is the feeling aroused by the perception part of instinct.

A loud strange noise at first arouses fear and we react for flight. After we know the meaning of the noise we act accordingly. The sound of an automobile horn as the pedestrian crosses the highway causes him to jump, but the same sound coming to his ears when he is indoors causes no instinctive response. Our instincts therefore as regards the emotional part can be modified by reason and experience. If we have no fear there is no instinctive motor response of flight and there is no physiologic response, and therefore, no interference with circulation and digestion. It is the emotion that directs the motor response in instinct.

Control of Instinct

It is not possible to stifle entirely the responses from emotional states although outward manifestations may be controlled. If we are afraid, the physiologic changes mentioned take place. We cannot control paling and flushing of the skin. The fact that we can force ourselves to not run away has little physiologic value. The important reactions from the hygiene standpoint have taken place. When we are afraid of things from which we cannot run away, as for instance, the approach of an examination or a duty which must be faced, the physiologic response is a handicap rather than an aid. With the body circulation deranged, the body functions less normally.

The person who thinks keenly and quickly in an emergency does so after fear has passed. At such times a person may assume a "deadly calm," he has per-

ceived exactly what must be dealt with and no longer fritters away his power imagining things. Fear always involves imagination of the unknown. The deer is a timid animal—and how it can run when frightened. Its ability to use its legs has saved its existence. Fear, then, when you need to run, but when you must face a thing out, you must abolish fear with reason. If you can supplant the emotion, then the instinctive physiologic response will not be forthcoming.

The spirit of aggressive combat is effective without anger, because man has an intellect which he can use to direct his efforts if the nerve paths are not clogged with the impulses of rage. "Blind with fury" is an expression that has physiologic basis. If the nerve channels are clogged with overpowering rage impulses, there is not room for other sensations of feeling, hearing or seeing. Such a condition is extreme, as is also the parallel condition of the undisciplined mind, "paralyzed with fright."

The way to control instincts is, then, to supplant the emotional states which are not desirable with intelligent, purposeful thinking or with other emotional states which are beneficial.

A person who is nervous about an approaching ordeal finds surcease from his fears in hard work which requires close mental application. We say that he has no time to think about it. That is not so. He has plenty of time but not room enough in his communication system to allow impulses of fear to gain sway over the thought messages that are necessary for the absorbing task in which he is engaged. A busy person has no time for worry, and after all, worry is only fear in homeopathic doses, continuously administered to the nervous system.

The courageous person has learned to take what comes without allowing new impulses to call up fear or worry. His reaction to strange stimuli is to think constructively and so avoid danger or disaster.

We can control the instincts largely, but we cannot break the connection between an emotion once it holds sway and its particular visceral response.

An alert and confident mind reflects a healthy tone in the nervous system and is a profound assistance to hygienic living. A few precepts for safeguarding the healthy state of mind are suggested.

If you are dressed in white duck and a passing auto truck splashes mud on you, be thankful that it didn't run over you.

Greet every annoyance with the mental question, "What of it?"

Remember that nothing can annoy you unless you let the emotion of annoyance gain sway.

Never cry over spilled milk.

Take ridicule or criticism as if it were uttered about a stranger.

Learn the first lines of Kipling's poem "IF."

"If you can keep your head when all about you
Are losing theirs, and blaming it on you;
If you can trust yourself when all men doubt you,
But make allowance for their doubting too;
If you can wait, and not be tired by waiting,
Or, being lied about, don't deal in lies,
Or, being hated, don't give way to hating,
And, yet, don't look too good, nor talk too wise—"

There is no better statement of the philosophy of mental hygiene than that expressed in these few lines. Tackle one job at a time. Forget the future until it comes. It will then be no longer the future. ✓

Care of the Nerves

Common predisposing causes to so-called nerve strain are improper feeding, sedentary occupations, unsuitable environment, lack of relaxation, undisciplined mental habits, misdirected nervous energy.

Proper care of the nervous system involves correct living, sufficient fun and relaxation, sufficient sleep, and proper vacations from daily routine.

The athlete does not wait until the contest before starting training. One does not learn self-control under fire without previous training. One cannot easily pull himself out of a nervous state without previous background of a disciplined mentality. The way to avoid nervousness is to prevent it while in health. The way to begin is to be serene in petty unimportant situations that might cause irritation if allowed to. Did you drop a thermometer? Perhaps you will have to buy a new one. What of it? Ten years from now who will know the difference? It is broken, isn't it? It can't be mended. The pieces may do for a stirring rod but not much else. It must be replaced anyway. Why fret about having dropped it? Much better to smile and pretend that it is funny. That certainly won't do any harm.

Calm acceptance of the inevitable makes for mental poise and serenity. Remember that what is done is done. Plan for future prevention of mistakes like those of the past, and what you cannot prevent, take as it comes. Perhaps it won't come.

A slang phrase now past its prime is worth retaining in our mental vocabulary. It is a good thing to say to oneself, "I should worry," and feel it to be true. When you are able to automatically without thought inevitably dismiss little troubles with a cheerful mental remark you have gained power. It requires for such a person less mental effort to meet calmly and with constructive planning the larger crises and troubles. But to one who lets himself go into even a little demonstration of temper or pettishness over small irritations, it is almost impossible not to give way to larger ills. Remember that it is the inward mental reaction that counts. To be able to keep an unruffled facial expression while boiling within is one sort of achievement, but it is only a partial achievement. To be sure, control of outward behavior leads to control of inward reaction and is a good way to start. We can fool ourselves almost as easily as we can fool any one else. Habits are strong. Mental habits are among the strongest. Make a start at once. Decide that it is futile to fret. Before you know it, you will reap the sure reward of serenity.

One must keep in mind the effects of stimulants and narcotics upon the nervous system. These agents affect the nerve centers, giving a temporary false sense of well-being but ultimately resulting in impairment of nerve function so that to the user there always follows a "let down." Tea and coffee contain substances which are mildly stimulating to the nervous system, affecting different individuals more or less strongly. Caffeine, the stimulant in coffee, is different from most stimulants in that it is neither habit forming nor does its effect normally result in any aftermath of depressing reaction. Some persons, owing to idiosyncrasy, are adversely affected by drinking coffee although it is not known what

ingredient of the coffee berry is responsible for this reaction. Such persons must obviously refrain entirely from coffee drinking.

Concerning alcohol, it may be said that from the standpoint of health and efficiency it has no beneficial effects. On the other hand it is a habit-forming substance, the continued use of which lowers mental efficiency and moral stamina.

Tobacco contains nicotine, a narcotic, which has been shown to have an injurious effect during the growth period. Although with adults its effects are less marked, it nevertheless does affect the nerves and the body mechanisms subject to nervous control, particularly the heart.

Habit-forming drugs such as morphine, codeine, opium, and other narcotics are particularly insidious because of the inevitable development of a craving for more and more which follows their continued use. The increasing dosages necessary to bring about the temporary sensation causes lasting injury to the nervous system. Their continued use to allay pain is recognized by careful physicians as being always to be employed with the greatest caution lest the habit be formed in the patient unawares.

Personality

Man is a social animal. Man likes happy appearing pleasant persons about him. In no field of professional endeavor is the possession of a calm philosophic temper more valuable to the possessor and to others than in the profession of nursing. The dignity of the position of the nurse makes the client look to her. Everyone knows that the calm, serene nurse is the valuable one. Her very serenity of spirit carries her through unusu-

ally trying situations, and because her mental equipment—her nervous system—is not clogged with footless messages of fear, fret, and worry, she is able to use that equipment for constructive remedial thinking. It is only necessary to try it a while to be convinced of the great usefulness of being calm in a crisis. And the way to be calm in great crises is to start on little ones.

Another reward that follows upon the attainment of mental discipline is the consciousness of power. When we find that nothing can fret us, we realize that we are competent to meet any situation and make a try at it. One need only look about among his fellow men to realize that not all have this power. He who has it then is more expert than his fellows in this regard. It becomes a source of proper pride and self-respect. He who has self-respect founded upon fact has the power that inevitably goes with ability. Confidence well founded is a great thing to possess. It brings success and increases confidence.

Confidence and Success

Confidence comes only after success has been experienced. The more successful experiences one has behind him, the more able is he to gain future success. But remember there must be for all of us a beginning. The first achievement will be small. Many small achievements taken together form a body of experience. If you have already begun to achieve successes in control of your mental self, keep on building up the list. If you are not sure that you have begun, begin now by deciding not to worry about what has been, but to watch out for some annoyance that you can banish with a smile.

In consideration of one's mental hygiene, it must not be forgotten that we all owe a duty to others as well as to ourselves. One duty we owe to others is not to inflict upon anyone our own troubles. Be cautious about seeking sympathy. Stand on your own feet. The other man is not more interested in your trouble than you are in his. Stop and think of the friends you like to have about. Are they cheery or depressing? For the sake of your fellow beings, cultivate optimism.

CHAPTER VI

MUSCULAR EXERCISE

Few will disagree with the suggestion that muscular exercise is a good thing. Of all those that agree to the general proposition, too few do anything about it personally, and still fewer know why it is a good thing or what exercise is supposed to accomplish.

Once upon a time men and women had no need to think about exercise. They had all that was required in the activities of maintaining life. Now there are groups of individuals who can barter their services for the essentials of life without contributing physical effort. The professions include such individuals.

The body has been developed for activity. The skeleton with its great masses of muscle attachments permits efficient and varied muscular activity and it must be assumed that the natural condition of the healthy body involves the use of these structures. The viewpoint that if these masses are not used the result will be merely a diminution in their strength and mass, is the erroneous opinion of the uninformed. As is well known to physiologists, the various parts of the body are interdependent. The smooth functioning of the whole depends upon the smooth working of each part in relation to the others. The evil from lack of exercise of the muscles, then, is not only an ill effect upon the muscles themselves, but upon other structures of the body. Mental occupations particularly seem at first inspection not to involve muscular efficiency, but the connection

between muscular efficiency and mental efficiency is one of the most obvious correlations of physiology.

There is an old motto, "*Mens sana in corpore sano*,"—a sound mind in a sound body. It is a good motto for each one of us to adopt. With a sound body there is the background for sound thinking. Thought, mind, intelligence, whatever they are, are intimately linked with the functioning of our nervous system. As pointed out elsewhere, the nervous system is a vast ramification of intercommunicating lines, called nerve fibers. These fibers are living tissue. Like all living tissue, they must be surrounded with suitable conditions for receiving nourishment and eliminating waste. Body fluids take care of both of these functions. If body fluids are mobile, they can perform their proper function, if they are sluggish they cannot quickly transport their proper loads.

Lymph and Blood

Other systems of the body are made up of living tissue having the requirements of some means of receiving food and getting rid of waste. The same common carriers, the body fluids, perform these functions everywhere in the body. A prime requisite for healthy life of the parts of the body then is a mobile efficient state of the body fluids. Exercise of the muscles moves these fluids about and in this way one of the greatest benefits from exercise is derived.

The body fluids are the blood and the lymph. The blood is largely water. That is what gives it its fluidity. In this watery part of the blood are suspended the red and white corpuscles and the blood platelets. Dissolved in it are various substances of the nature of potential food or cell wastage. It also holds in solution mineral

salts. The blood is contained in a closed tube. This tube twists and turns and has many branches, but each branch ultimately returns to the main stream. The heart is essentially an enlargement of this tube, folded upon itself and surrounded with muscular walls. The blood does not flow at random through the body. The tubes containing the blood do meander among the tissues, but the blood as such does not leave these tubes.

Food

The lining of the blood vessels is a permeable membrane, permeable to water and to amino acids and salts, as well as to the gases carbon dioxide and oxygen. The smallest blood vessels, called capillaries, have for a wall little more than this thin membrane. Through this wall, water and diffusible substances can pass out by the well-known laws of osmosis and diffusion, and likewise under proper conditions, similar substances can pass in. Whether water and dissolved substances can pass in or out depends largely upon conditions surrounding the capillaries.

Waste

When, for instance, work is done by any of the cells of the body, waste products are formed. These waste products collect in the region where they are formed and consequently there is built up a concentration of these dissolved substances around certain capillaries. When this state of affairs occurs, there being in the blood inside the capillaries a low concentration of these substances and in the fluids outside the capillaries a high concentration of the same substances, we have a condition like the old osmosis experiment reversed. It is as if we had a bag of membrane filled with water

(representing the blood) surrounded with a sugar solution (representing the fluids outside the capillaries charged with waste materials). The waste materials are diffused through the capillary membranes into the blood which sweeping along constantly at a rapid rate sweeps the wastes with it. They travel with the blood and do not to any great extent diffuse out in the other areas of low concentration because the blood travels so rapidly. On arriving at the special arrangement of capillaries in the lungs or kidneys, however, the flow is so distributed through many channels that each little stream of blood is flowing rather slowly. This gives time for diffusion to take place, and the waste materials leave the blood through the capillary walls into the spaces of the kidney collecting tubule or into the spaces of the lung cavity as the case may be.

On the return journey, blood charged with food picked up in the liver or in the portal system passes through the same tissue capillaries and now the condition is like that of the bag of sugar solution immersed in clear water. The sugar in that case travels outward through the walls of the bag. The food substances travel from the blood through the capillary walls to the fluids on the other side. In actual life, these two processes go on simultaneously. Wastes and food do not interfere with each other. The capillary walls are sufficiently extensive in area so that there is room for one set of products to pass in one direction while the other set of products passes through the same membranes in the opposite direction.

Now what of this fluid outside the capillaries? It is the lymph. The condition of the lymph and the body is quite well illustrated by the simile of a bog. In the bog we have soil, roots, stones, various kinds of living

tissue and nonliving materials all submerged in a great bed of water. Water is everywhere where something solid is not. It fills all the interstices and contains in solution salts of the earth and dissolved organic matter. Our body is like a bog with the difference that it is enclosed by a more or less tight skin. Under the skin are tissues, but filling all the interstices between the tissues there is lymph.

The earliest animals were marine animals living in the salt water. We do not all of us realize that we are all still living in salt water, that our cells are bathed in salt water, for the lymph contains in solution much the same salts in the same proportions that were present in the ocean of olden days.

Body cells require moisture for their life just as single cells like the bacteria require moisture for their continued life. The single-celled animals and plants take their food from the surrounding moisture by the diffusion of dissolved substances through their own permeable membranes from the water into the cell. They produce waste materials in the processes of their life, and these waste materials, when in sufficient concentration, diffuse out from the cell through its membrane into the surrounding water. The cells of the body usually require food and produce waste in a manner similar to the bacteria. Naturally, then, they must be always surrounded with moisture.

In cases where the cells are packed tightly together in firm tissue structures, the transfer of food and waste may be from the cells inside the mass to those on the outside and thence between cell body and lymph. But always there must be lymph if the cell is to continue to live. The lymph serves as the carrier between blood and tissues.

In the bacteriologic laboratory, cultures are grown in tubes of watery media. It is well known that in a given culture, cells will live and grow rapidly for a certain time and then begin to lose their vitality. The reason is that the surrounding fluid of the culture medium has become so charged with the products of respiration and other wastes from the bacteria that there can no longer be prompt and ready diffusion of the wastes from within the bacterial cell to the surrounding fluid. It is like the case in the osmosis experiment when the sugar inside the membranous bag has so diffused to the outside water that the concentration on each side of the membrane is equal. There is then an equilibrium and no further diffusion takes place.

If an equilibrium is attained between the waste materials inside a cell and the waste materials in the lymph outside the cell, death of the cell ensues. If the concentration outside the cell is great but not quite equal to that inside, then diffusion is slowed down and the cell eliminates its wastes with corresponding slowness, and loses its vigor.

The bacteriologist meets his conditions by renewing the watery medium surrounding his bacteria, that is, he actually takes up some of the bacteria and transplants them to a fresh body of fluids. If he could filter off the bacteria and hold them in the same tube while the old fluid was passed off and a fresh supply renewed, he would attain the same result. Again he could secure continued growth of his organisms by inserting in his culture fluid a bag of permeable membrane filled with fresh nutritive solution. Wastes from the old culture fluid would diffuse into the bag, and food from the bag would diffuse out into the original mass of liquid. His

bacteria would under such conditions continue to grow as well as ever.

The arrangement in the body is like this last hypothetical condition of the bacterial culture. In a healthy body the wastes from the cells diffuse into the lymph. The lymph is free to move, and its contents are brought against capillary walls. Through the capillary walls the wastes are diffused into the blood and swept away. At the same time, from the blood in the same capillaries, food substances diffuse out into the lymph where they become available for transfer by a second diffusion process into any cells with which the lymph is in contact.

If the lymph were quiet in the body and not free to move, if it were pocketed by sagging organs so that it had not free access to the cells on the one hand and the blood vessels on the other, we would not expect so complete an exchange of wastes and food. In such a case the cells would not be expected to grow or even live vigorously. From these considerations it must be obvious that it is of value to *keep the lymph moving*.

Lymph Movement

One hears sometimes of the circulation of the lymph. That is an unfortunate expression. In one sense of the word some of the lymph goes through a sort of circulation but the circuit is an irregular one. The bodily provisions for lymph movement are as follows. There is throughout the structure of the tissues a net work of tubules, some of which are open at the outer ends. All of these collecting tubules dip into the body fluid, the lymph. The tubes, small at first, converge to larger and larger trunk lines until ultimately all join in one

duct, named the thoracic duct, which in turn empties into the vena cava near the heart. At various points along the system of lymphatics are flap valves which permit fluid to pass in one direction—toward the heart—but not in the other direction.

Lymph fills these ducts and from them is intermittently squeezed out into the blood stream. The action is something like the working of an old-fashioned water syringe in which a bulb midway of a rubber tube, open at each end, when squeezed forces water out of one end and as the bulb is released draws water in through the other end of the tube. A second squeeze of the bulb sends the new charge of water out through the upper end of the tube and as the bulb is released again more water is drawn in from the lower opening.

Respiration and Lymph Movement

The thoracic duct passes through the thorax, hence its name. At every respiratory movement of the chest walls the thoracic duct is manipulated like a rubber bulb as just explained. When the chest wall falls in expiration there is created in the thoracic cavity a pressure which is slightly greater than the pressure of the atmosphere. That pressure compresses slightly the blood vessels and the thoracic duct against which the pressure is operative. There is squeezed out from the thoracic duct a small charge of lymph into the blood stream. At the next inspiration the first movement is a raising of the chest wall creating temporarily of a partial vacuum which the air rushes in to fill. Momentarily there is a release of pressure on the walls of the thoracic duct. It fills again with lymph.

Blood cannot flow back into it because at its junction

with the blood vessel there is a flap valve which prevents flow of anything backward into the thoracic duct. The lymph which fills it then must come from lower down in the chain of lymphatic vessels. This means that all along the lymphatic system there is a slight suction of lymph upwards toward the final destination. Just as when at a ticket window there is lined up a long string of persons awaiting their turn at the window, all are still for a moment as the one at the head of the line causes delay, perhaps to secure his change. Then as the leader leaves, and the next one takes his place, all move up an inch or so. Ultimately the last one in the line has reached the window.

There is never a last drop of lymph. As fast as it is emptied into the blood stream where it becomes part of the watery portion of the blood, an equivalent portion of salt water diffuses through the capillaries somewhere from the blood into the lymph spaces.

This steady draining of the lymph from the body spaces and its return through the circulation to enter its former position from a new portal serves to keep the lymph from becoming stagnated in any one place. This is the so-called circulation of the lymph. A more descriptive term would be movement of the lymph.

Exercise and Lymph Movement

Another way in which the lymph is moved about in the body is in a manner similar to the squeezing of water out of a sponge. If pressure is exerted upon the tissues it squeezes the lymph in that immediate vicinity and causes it to move elsewhere. Exercise of the muscles does this. When muscles contract they exert a squeezing action upon the lymph which bathes them.

It temporarily is moved aside. When the muscle relaxes, some lymph comes back to the old position, but it may not be at all the same lymph that left. In this way the supply to a given area of cells is renewed through muscular exercise.

If all the muscles of the body are exercised, all the lymph is moved about and none of it becomes stagnant. If only one part of the body is subjected to muscular activity, only that part secures the major benefit insofar as lymph movement is concerned. If none of the muscles are exercised the lymph is to that degree more likely to need stirring up.

Exercise and Blood Circulation

Another effect of muscular exercise is to increase the circulation of the blood by removal of congestion. Congestion is a state in which for some reason the flow of blood through one or more of its normal channels is interfered with. Pressure on the capillaries is the frequent inciting cause. Pressure of this nature slows down the flow of blood through the restricted capillaries and the white cells of the blood tend to stick to the walls of the vessel and clog them up. Then the white cells begin to migrate out through the capillary walls into the surrounding tissue spaces, crowding the adjacent living cells. Some of these tissue cells are no longer able to obtain proper nourishment or to rid themselves of waste. They die of starvation, suffocation or poisoning from their own products of life. They form food for chance infections, perhaps. In any case, the tissues in the area of congestion suffer a diminution of their normal vigor.

Congestion and Its Relief

The relief of congestion is by the removal of the pressure which instigated it. This can best be accomplished by moving the tissues that are causing the pressure. The best way to move any tissue is to engage in bodily exercise. Massage, when possible to get at the site of congestion, may relieve it. That is why osteopathic manipulation can sometimes break up a head cold by artificially exercising the tissues which are the site of congestion and thus restoring normal circulation.

One region of the body commonly liable to congestion which cannot be relieved so readily by manipulation and massage is the region of the abdominal viscera. Our abdominal muscles were developed to support the viscera when we were in the four-footed position. Now that man stands on his two feet the abdomen has a tendency to sag. It is therefore necessary to take thought of our standing position or posture. If the stomach drops down onto the intestines, there is a tendency for the abdomen to be bulged down and outward. This puts a strain on nerves which are not made to stretch, and in addition it tends to compress the blood vessels of the region about the digestive apparatus where the blood supply should be plentiful.

If the abdomen is retracted, these organs are pulled back into place and the unfavorable conditions which in most persons have caused some degree of abdominal congestion are removed. Exercise which moves the abdominal muscles, twisting movements which move the viscera and allied exercises are, therefore, especially valuable for the sedentary individual and are desirable for all who walk on two feet.

Exercise and Respiration

Another effect of physical exercise is to increase the respiration. This involves the exchange of gases between the muscles and the lymph, and between the lymph and the blood. Deeper breathing also sweeps out the pockets of the lungs which ordinarily are little used, heart action is strengthened, and general metabolism is speeded up.

General Benefits from Exercise

Among the latent effects of regular exercise wisely undertaken and regularly repeated are better elimination of wastes, better tone of body tissues, more alert mental condition.

Among the special benefits attributed to regular exercise of not excessive amount is a strengthening of the heart. The heart is essentially a muscular structure. Its beating is due to the rhythmic contractions of its muscle. Like any other muscle, proper exercise with some degree of extraordinary work is beneficial. This muscle, like other muscles, is improved in tone and efficiency by a wise amount of exercise.

Any muscle which is used becomes adapted to meet an overload without becoming unduly fatigued. In times of emergency action, the exercised heart responds promptly and efficiently while the soft flabby heart that has been beating along only strong enough to take care of the limited load of soft living becomes fatigued and may fail when the emergency arises. The way to guard against future premature failure of the heart is to exercise it while it is in fair condition. Most types of weak or irregular heart action can under suitable direction be improved by suitable exercise of the body muscles involving indirectly an exercise of the heart.

Types of Exercise

The kind of exercise is not of vital importance except that it should involve the muscles which most need exercise. These are in general the abdominal muscles. Trunk twisting and bending or sports which involve trunk movements are therefore to be preferred. Walking may utterly fail in this regard unless thought is taken to swing the body and hips at each stride, and this produces an ungainly gait.

“Stomach In”

An exercise which may be practiced while walking, or for that matter, while doing anything, even while sitting still, is to voluntarily pull in the front wall of the body in the region commonly though erroneously referred to as the stomach. By voluntarily pulling in the abdomen, the intestines are pulled back and up, the stomach is pushed back where it belongs up under the curve of the diaphragm, the chest is forced up and out, all without particular effort.

Practice “stomach in” by voluntary effort say twenty times in the morning as soon as your eyes are open before you arise. You will be surprised how much exercise it affords. Then increase the number of times to fifty. If repeated once per second this takes less than a minute. Most persons find that to do this strongly many times in succession is at first fatiguing, if the abdominal muscles are soft. All the more reason then to keep at it day by day. Another plan, easy to follow, is to pull the stomach in for the first block when you start to walk anywhere. When it becomes too fatiguing to hold the abdomen pulled tightly in let

the muscles relax. You have made some headway each time that you have tried. If leading a quiet existence in office work, pull the stomach in each time you reach for the telephone, or each time you reach for a door knob. By keeping at it you will soon be able to form a habit and do it without thinking. In surprisingly short time the muscles over the front of the abdomen will be firm and not sagging. It will be found that you cannot pull the stomach in so far as formerly because it has not sagged so far between efforts. Your carriage will improve before you know it. And with the consciousness of improved figure there is a feeling of self-respect aside from the improvement in physical well being.

Posture

Attention to the posture is not necessary when the stomach is held up in its proper place. The chest takes the proper position and gravity holds the body erect.

Another way to attain correct standing position, is to imagine a string hooked into the blouse directly over the sternum. Imagine this string to be suspended from the ceiling tightly. The head must be held so that the features will not hit the string, and this brings in the chin as it should be. In the effort to avoid tearing the blouse, the chest is held up, and this throws the shoulders back naturally and without strain. As the chest is pulled up the abdomen comes in. When the body is in this erect position the weight naturally shifts so that it comes over the balls of the feet. The feet may be placed naturally, which will be, usually, not close together, and approximately parallel. Heels together and toes out is not a natural or scientific placing of these

structures which must support the whole body. Turning the toes out throws the weight to the inside of the foot where there is the least support.

Sitting

In assuming the sitting posture that will relieve the viscera of congestion, it is necessary only to sit well back in the chair and pull the stomach in strongly. The rest of the trunk then takes care of itself.

Lounging

Of course lounging is different. At times it is relaxing to lounge in unscientific attitudes. The danger of this practice is in the matter of habit formation. Whenever he sits, the loungee comes to lounge, perhaps to one side or the other with chest lax and abdomen sagging. To sit with the back curved outward resting the weight on two spots, one near the back of the collar and the other somewhere lower down on the backbone is reprehensible at any time. It is not really comfortable, and leads to a sloppy feeling entirely devoid of self-respect or dignity.

The other extreme of always seating oneself bolt upright gives an appearance of discomfort and prevents relaxation. The erect easy position with the back suitably supported is in the long run the most comfortable as well as the most hygienic. What effect on hygiene may come from the present well-nigh universal tendency of throwing one knee over the other immediately upon seating oneself is hard to predicate. It may, however, have a tendency to encourage supporting the weight of the trunk, thus thrown out of balance, on one elbow. Since the habit in this regard is to cross

one particular knee over the other, the tendency to force the spine into a lateral curve may not be negligible. It is easy to strain at a gnat and to pick out minor faults for correction when the really important general considerations are overlooked. And, after all we are here to live for usefulness and not spend undue effort in perfecting every theoretical detail of the business of living except as the result in healthy useful living warrants the effort. Habitually correct posture, however, makes lounging uncomfortable.

It must be realized that the carriage of the body has great effect on health and comfort. The person who habitually maintains a good position of the body with lungs not cramped and viscera not crowded, with spine erect, looks better and feels better than he otherwise would.

Fatigue

The nurse while on duty is on her feet a great deal of the time. She is called upon to lift heavy loads. She cannot always stop when she becomes fatigued. It is useful for her to know the causes of fatigue, how it can be warded off, and how recovery from fatigue may be induced.

Muscular fatigue comes from the use of muscles. Each muscle of the body is a bundle of fibers. Each muscle fiber is in a sheath of delicate membrane and the membranes of a given muscle bundle are joined together. The fiber is a cell. Like any other living cell it requires nourishment which it receives through its membrane by diffusion, and it produces wastes which it discards through the same membrane.

The cell of the muscle fiber differs from other cells of the body in that it has one quality developed to a

very high degree, the ability to contract when stimulated. Each muscle fiber has a nerve connection through which stimuli may arrive at that fiber. Whenever such a nerve impulse does arrive at a muscle fiber, that fiber will normally contract. When messages arrive simultaneously at all the fibers of a given muscle, they all contract at once and we can see the result in the movement of the whole muscle bundle. The muscle seems to swell.

Muscle contraction always means motion. It is not possible to have motion without expenditure of energy. Muscle contraction therefore always uses up some of the body's supply of energy. The energy thus converted comes from the food absorbed from the digestive organs and transported by blood and lymph to the muscle cells. As a result of this conversion of food energy into the energy of motion, there are left over certain products which in the usual run of events will not yield further energy to the body. Such substances as carbon dioxide and sarcolactic acid are formed in the muscle cells and must be eliminated. If the muscle is in good condition with a plentiful supply of lymph and blood, these waste products diffuse out rapidly and some of them are washed away. Part of them are oxidized to useful products capable of yielding more energy, but most of this material must be removed from the region of the muscle if that muscle is to continue to work.

Fatigue Substances

A muscle that has not been kept in good physiologic condition by proper attention to exercise tires readily when called upon to work. The reason that such a muscle tires rapidly is that the products left over from

each muscular contraction are not removed. A muscle that is not exercised loses its tone, and its power of contraction is weakened, but still more harmful is the result that it cannot promptly get rid of its manufactured wastes. We say that such a muscle becomes fatigued. And because the condition of muscle fatigue sets in when the accumulation of sarcolactic acid and allied substances becomes too great, these substances have been called fatigue substances.

The cause of fatigue is the accumulation of fatigue substances in the region affected. Fatigue substances accumulate when they are produced faster than they are removed. For the adequate removal of fatigue substances good circulation of blood and free movement of lymph are essential. These two things are attained by systematic exercise and correct general hygiene.

To recover from fatigue one usually endeavors to rest. In the process of resting we cease to manufacture excessive amounts of further fatigue substances by allowing the muscles in question to be quiet and relaxed. We then wait until the slowly moving lymph and sluggish circulation wash away or oxidize the accumulation of fatigue substances. When this has been accomplished, the fatigue has disappeared.

Fatigue substances act by preventing the nerve stimuli sent to a muscle fiber from acting upon that muscle fiber. The fiber is not usually unable to contract even though fatigued, but unless nerve impulses or some other kind of stimuli reach it, it will not contract. Fatigue is a warning to do less muscle work. If sarcolactic acid were to accumulate indefinitely, there would come a time when it could coagulate the tissue of the muscle cell and the muscle would go into rigor. The rigor mortis is induced largely by accumulations

of fatigue substances after the life process of oxidation has ceased and the blood and lymph no longer circulate. In life the symptoms of fatigue warn us for a time from excessive activity of our muscles and in addition the effect of fatigue substances is to prevent excessive contraction of a fatigued muscle. Forcing oneself, therefore, to work continuously beyond one's strength is a dangerous practice. It is disregarding Nature's warning.

Fatigue may be postponed, however, by strengthening the muscles and improving their hygienic condition. A strong muscle does not fatigue so readily as a weak one. Whatever the work we have to do, we should see to it that there is sufficient muscular development and tonus to enable us to accomplish more than the ordinary routine without excessive fatigue.

Recovery

Recovery from mild fatigue of the day should be complete after a night's sleep. Recovery from fatigue of a particular set of muscles is often hastened by recreation involving a different set of muscles and different mental occupation. Mild excitement has sometimes a beneficial effect in stimulating a general improvement of the circulation. To state such a fact nowadays seems always fraught with some risk. So many diversions are at hand, so many calls for this or that social activity are constantly present that to deliberately seek excitement seems dangerous. We most of us probably have enough or too much nerve stimulation. The nurse, however, after a long case of confining routine may profit by the theater or the dance or any sort of mental or physical change, provided it does not merely increase fatigue.

All work and no play makes not only a dull boy but also a dull girl or woman. As an antidote for exacting duties specific attention needs to be paid to recreation. Recreation to have its greatest benefit must be pleasant and enjoyable. It should preferably be as different from the daily duties as is possible. To one who is constantly rendering service to others a complete change is offered by being waited upon. To go to an attractive restaurant where the service is intended to please the senses is a suggestion for such. Reading and games offer contrasts to physical labor and constructive thought. Games should be played for the fun there is in them and not primarily to win. Physical sports are not necessarily the best thing for the nurse except as pleasant participation in the outdoor air is included. The worker indoors should try to get out as much as possible. If the day's occupation means walking about indoors an airing is perhaps better taken as a ride than as a walk. To get into the country and relax near Nature is a healthful antidote to confining sick-room duties. Whatever is chosen, play while you play and forget work for the time. And remember that sleep is Nature's great restorer of tired bodies. A rested body induces a rested spirit.

Body Mechanics

A subject which is closely allied to the hygiene of exercise is the proper use of the body in physical work. The human body is often referred to as a mechanism, and like any other mechanism, it should be used properly in order to gain from it the best and most efficient service. The subject of body mechanics includes a consideration of how to stand properly, how to

be seated, how to stoop, how to lift, in general how to utilize the skeleto-muscular mechanisms to best advantage.

Correct poise and use of the body at all times constitutes good body mechanics. The functions of the various organs of the body must be able to continue while work is being done, whether it is in carrying a load, bending over, or in any other position. The chief attention needs to be paid to the chest, back and abdomen. Arms and legs are generally used sufficiently to keep them in tone, certainly in the varied duties of the nurse. Moreover it is not enough to hold the body correctly for a few hours if the rest of the day is spent with the body slumped.

Standing Position

The position for standing has been stated. It will be reviewed. Standing erect the chest is arched, the head poised above the neck, not dropped forward or strained back. The chin is drawn in so that the glance is level, neither shamefacedly out from under lowered brows, nor superciliously directed along the nose. The chest being arched the abdomen naturally comes in. Either effort will bring the other. Arching the chest pulls in the abdomen, and pulling up the abdomen arches the chest. Possibly the idea of a pull from the chest is better than a push from the abdomen. Attention may well be paid to both items. The head, shoulders, spine, hips, knees and feet are in balance. Generally the head, shoulders, hips and feet are in line with the knees, possibly slightly ahead of the line if the weight be on the balls of the feet as it should be. When in this position, if the weight is properly distributed, rising on the toes

should raise the whole body without forward or backward swaying. The arms hang naturally and are given no attention. The spine is slightly curved like a nearly straightened out letter "S." The deeply curved back which results from merely throwing back the shoulders is harmful. The deeply curved back which is the result of a sagging abdomen is worse.

Trunk Muscles

The important muscles for good posture are the trunk muscles. These are the muscles that need especial attention. A simple exercise for these muscles has been suggested. Other means of correcting improper relations of the abdominal conditions may be employed with value.

The simplest exercise is to lie on the back with the hands behind the neck or behind and above the head. In either case the elbows should be laid flat. Do not force the breathing, but pull in the abdominal muscles as strongly as is comfortable. Consciously flatten the spine in the lumbar region. Vary this by raising the knees. Now flatten the spine until the tip of the coccyx is away from the surface you are resting upon. When the lumbar curve of the spine is smoothed out, alternately relax the abdominal walls and then contract them. This is a position in which the strain on the back is usually relieved and will be found to be restful.

Another variation is to take correct sitting position with the gluteal region pressed against the back of the chair and the feet square on the floor. Arch the chest without strain, draw in the abdominal muscles and press the sacrolumbar region against the chair back. You will feel the pelvis rotate about the hip joint. Now lean

back keeping the chest up and the head poised high, draw in the chin, and relax the abdominal muscles. Force the air in and out of the lungs by using the abdominal muscles only, for a few times. This exercises the diaphragm and attached structures and promotes better circulation in the visceral region as well as strengthening the abdominal muscles. Now relax the abdomen and breathe naturally, maintaining correct poise. Notice how the abdomen falls out when allowed to relax. Let the chest fall and see how obviously bad the position is with respect to that which you have just held. Take the correct position again and see how much better it feels. Arise and again take the proper sitting position step by step until you can do it easily. Try it every time you sit. If you persist in it, you will soon make it a habit. Having learned how to sit and stand correctly, observe others and *mentally* criticize their position. When you see how badly most persons sit you will unconsciously, if you are an average human being, take the correct position yourself because of the proper feeling of superiority it gives you.

Stooping

In leaning over a patient there is a right way and a wrong way to hold the body. The simplest way to remember the right way is to remember to hold the lower back stiff and bend by using the hip joint. Bending the back when stooping allows the abdomen to become cramped and the chest to become hollowed. If you have not been in the habit of bending from the hips, it will at first feel as if you are posing. But, after the position has become habitual, it will be found that the backaches at the end of the day are less likely to appear.

Curved Spine

The standing exercise for straightening the lumbar curve is obvious. Stand correctly poised as to feet, head and chest, about three or four inches from the wall, back to it. Pull back the lumbar region and contract the abdominal muscles rotating the pelvis about the hip joint until you touch the wall. Now relax the abdomen and step forward maintaining the correct posture and stretching as tall as possible. If at first your gait is ungainly do not worry but persist, focussing the attention on the sacrolumbar region and advancing the weight evenly to the ball of the forward foot naturally. Take short steps. Have some one to criticize your progress and take turns at it.

Appearance

The general bearing of the person who carries himself in good poise, using his body as it should be used, with the head held erect in an attitude of self-respect is impressive. Hold yourself as you would if your fellow beings were financially indebted to you while you secretly had decided not to collect the debt. You will radiate self-respect and power and you will moreover by your very poise command the respect which is due you as the possessor of a sound physical mechanism well cared for.

Correct posture is not a strained position; there is no rigidity to it. To the observer, good posture carries an impression of physical alertness. To the person who maintains good posture, there is a sensation of physical and mental alertness. One who is interested in something sits up and observes alertly. Likewise one who

sits up and observes finds much that is of interest in life.

Sacroiliac Strain

A difficulty that is experienced by many, especially those whose duties keep them on their feet, bending, lifting, and carrying burdens, is difficulty with the sacroiliac junctions. In this affliction there is actual displacement of these junctions, and the resultant pinching of nerves in the pelvic region causes excruciating pain. Sacroiliac troubles are prevented more easily than they can be cured. The predisposing causes are sudden shocks or long continued strains.

Sudden shocks such as one receives when in climbing a flight of stairs he takes one step too many, or such as may be received in jumping, or even in horseback riding, put a tremendous strain on this joint. If the muscles and ligaments (especially the gluteal muscles) are not in good tone, the jar will not be withstood.

Long-continued strains incident to working while on the feet are predisposing to sacroiliac troubles if the body be not held in proper posture and if its use be not mechanically good. An exaggerated lumbar curve must be considered as favoring sacroiliac strain. Where the lumbar spine is curved excessively, the sacrum is tipped forward and the weight of the body is not supported through the hips. The method of preventing this common cause of strain is to maintain correct carriage of the body, especially with respect to the proper relation of sacrum and pelvis. Such correct position has been indicated, as well as the means of attaining it.

If sacroiliac weakness has developed, proper corsetting to supply artificial support of parts is necessary. A corset for such purposes should be fitted to measure

by an expert who must also give instructions in the necessary manner of putting it on.

Benefits from Correct Body Mechanics

Among the benefits from correct posture and proper use of the body are the following:

The stomach and adjacent structures are in their proper position and do not crowd each other or pinch the blood vessels which are supplied to that region.

The stomach and viscera being in proper position, there is not the physical discomfort which comes from stretched and strained muscles and ligaments or nerves. Backaches may be largely attributable to a sagging abdomen and the strain which such a condition puts on the system. Backaches may be prevented largely by correct posture.

Headaches are often related to improper abdominal conditions of congestion, strain, or interference with peristalsis. Such conditions are prevented by correct posture.

Good posture unfailingly carries with it some feeling of self-respect. It brings about a mental condition that corresponds with the physical picture of the alert carriage, the springy walk, the level glance. It is keen human common sense that has styled the self-confident individual as "chesty." A well arched chest habitually maintained breeds confidence, and the type of self-respect that comes from proper pride in a well poised body breeds respect of others and friendly admiration.

The type of muscular exercise to be indulged in must be selected with the general principles stated above kept in mind. Exercise of the trunk is especially to be desired. Exercise that is fun is more beneficial and

more easily persisted in than mere gymnastics. Exercise should not be carried to the point of excessive fatigue. It should be sufficiently vigorous to stimulate the sweat glands and should always when possible be followed by a cleansing bath ended by stimulating cold water and vigorous toweling.

Do not neglect to allow the body to rest and recuperate after exercise, and do not forget that exercise immediately after eating interferes with digestion.

CHAPTER VII

FEET

Foot Structure

The care of the feet is especially important for those whose duties involve much walking or standing. The prevention of foot trouble must lie with the individual rather than with the shoemaker although the latter can help. Shoes alone will not prevent foot ailments if the feet are not properly used.

To understand the hygiene of the feet one must appreciate their structure and how they normally serve their purpose of support of the body.

The feet are made up of bones, muscles and ligaments, so combined as to be able to support the body in a variety of positions. The bones of the feet are illustrated in Figs. 5 and 6. The weight of the body bears directly upon the astragalus and from this bone is distributed to the heel and to the ball of the foot through the various intermediary bones.

Between adjacent bones are joint surfaces smoothly lined with membrane and in health, always well lubricated. Ligaments which are flexible but not elastic hold the bones together and permit joint movements without improper displacements.

Tendons from the muscles of the leg are attached to the upper and lower surfaces of the foot and transmit the opposed pull of these muscles to bring about movements of the foot as a whole. Short muscles control toe

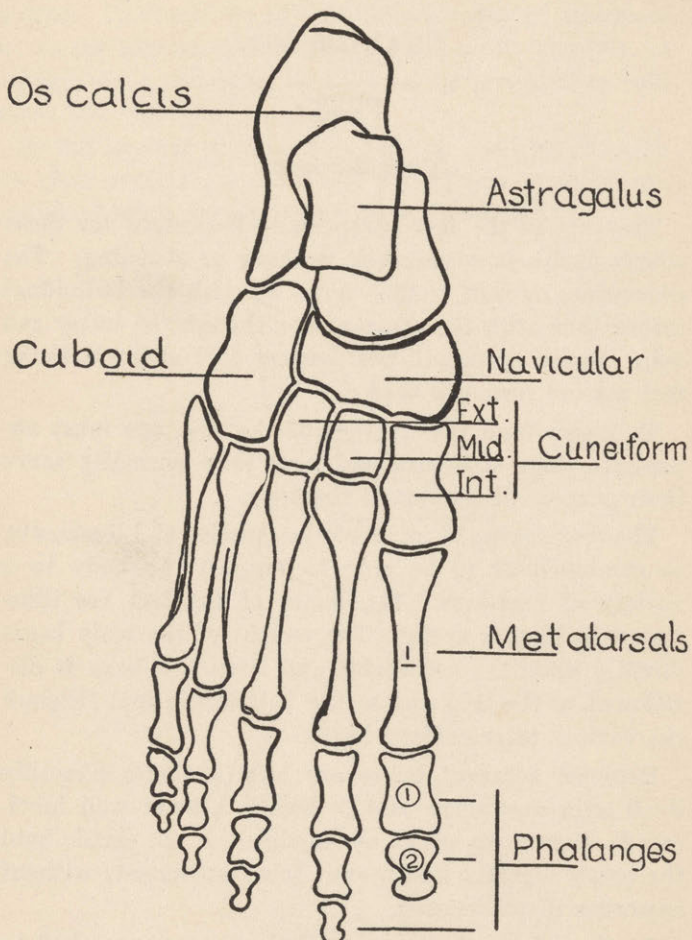


Fig. 5.—Bones of the right foot, dorsal aspect.

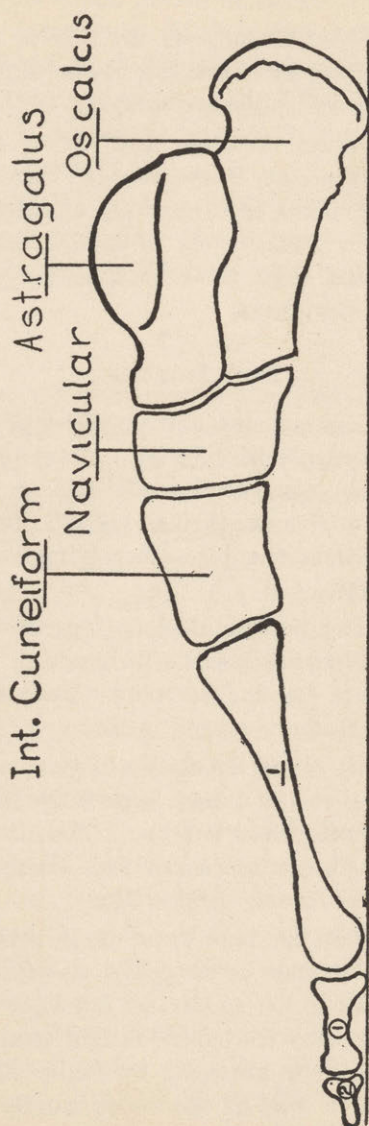


Fig. 6.—Bones of the right foot, inner aspect.

movements. Short muscles on the sole of the foot are covered by a sheet of nonelastic fascia which binds the whole together and prevents splaying of the foot.

There are veins, arteries, capillaries, and nerves. Motor nerves terminate in the muscle fibers, and sensory nerves start from the regions of the muscles, joints and other structures. The whole is padded with some fat and covered with skin. Foot troubles may involve any or all of these structures.

Foot Troubles

Among the less common abnormalities of troublesome feet may be irregularities in bone development due to faulty nutrition, congenital tendencies, or to artificial displacement of bones during growth due to faulty shoes. Diseases of the bones involving structural defects are possible.

Ligaments may be stretched by improper use of the feet such as improper position in walking or standing. When ligaments become stretched bony displacement follows. Flat feet are caused in this way.

Congestion of blood circulation may cause inflammations to set in at the joints, especially if bacteria or their toxins are in the circulation. These inflammations may yield to proper measures and disappear or may degenerate into chronic misfunctions.

Ligaments may be torn from their attachments by violent effort or may be stretched slowly by repeated strain. Muscles if too small and not kept vigorous by proper exercise, may contribute to foot strains. Muscles are affected in their nutrition by faulty blood circulation. Like other cells of the body, muscle cells in the feet require food and suitable conditions for waste dis-

posal. Muscles which are to be subjected to prolonged use by those who work on their feet need especial attention to insure good movement of surrounding lymph and contributory circulation. Rest for heavily worked foot muscles is absolutely necessary if fatigue is to be followed by recovery.

Nerves from the feet transmit sensations sometimes weakly, giving a feeling of numbness, and sometimes too freely causing sensations of tenderness.

Arches

The foot as a whole presents the picture of two arch structures. The longer arch has its bases at heel and great toe with its highest point at the inside of the foot nearer the heel than the toe. It is called the longitudinal arch, and is what is commonly referred to when speaking of "the arch" of the foot. This arch is quite or nearly flat on the outer edge of the foot. In babies it appears entirely flat. In some barefoot races the space under the longitudinal arch is so filled with muscle as to seem to be flat.

The adult usually has a space under the high point of this arch. At the highest point of the arch the astragalus is mounted and on this bone the weight of the body is taken. From the astragalus the weight is distributed through the other bones of the foot to the bases of the arch. Downward pressure on the astragalus tends to flatten the arch against the restraining tendons and especially the great sheet of tendinous material known as the plantar fascia, stretching from heel to ball of the foot. Tendons from muscles of the back of the leg run forward under the foot to their attachment under the toes. So long as tension is maintained on

these muscles they too help to prevent the arch from giving way under the weight of the body.

When in walking or standing one toes out, the weight of the body on the astragalus pushes the arch over sideways toward the inner aspect of the foot. If this tendency persists, the arch may be tipped over sideways. This is one type of flat foot. If, however, one toes in the weight is thrown to the outside of the foot where the spread of the toes offers ample buttress to the arch against any force tending to tip it over to the outside. This is the reason for walking with the toes pointed ahead and not outward. It also explains why the tired workman lolls with extended feet resting on their outer edges, a position which relaxes fatigued ligaments and muscles.

The second arch of the foot is the transverse arch between the great and little toes. It is often flattened in walking and may even be reversed by the pinching of too narrow shoes. High heels that throw the weight forward onto the toes and at the same time crowd the toes into too narrow quarters tend to reverse this transverse arch and at the same time to cause the longitudinal arch to buckle upwards.

An aristocratic high instep is not necessarily a strong arch. It may mean an arch broken upwards instead of downwards. Likewise a flat foot which is strong and flexible, in which muscles and ligaments have become adjusted to the flat position of the bones of the longitudinal arch, may be a perfectly satisfactory foot from the point of view of strength. It is the falling arch, not necessarily the fallen arch, which is painful.

The great toe of the normal foot points in a line drawn through the heel and the ball of the great toe. Toes which bend in toward the others and away from

this line are usually the result of the constriction of shoes not wide enough at the toe or with a toe space not in correct alignment. The correctly shaped shoe allows the great toe to extend forward as it is meant to do.

One cause of flat feet is too great body weight. An increase in weight of the body is an increased load on the structures of the foot. If these supporting structures are not strengthened by use to assume the increased load, something has to give way. This may quite likely be flabby leg muscles whose tendons run under the foot. Strain upon these leg muscles is manifested by pain in the calf or shin region, or possibly at the knee.

If the stretching process continues, the bones of the foot will gradually settle into new positions and their inner surfaces must assume new relations with each other. This may cause a rubbing of tender synovial membranes with resultant irritation and inflammation of joints. Tenderness or dull aches are the result, and it is painful to stand on such feet.

Remedies

If foot distortion has not been prevented it can be cured in its early stages by careful attention to the feet. The cause of the abnormal condition must be diagnosed. If it be a muscle stretched beyond its strength, then that muscle must be rested until restoration of its normal tone has been brought about. In such case keep off the feet as much as possible. Avoid carrying heavy weights. Perhaps it may be well to have the muscle reinforced by properly applied longitudinal strips of surgeon's tape. Do not try to strengthen a weakened

muscle until it has first recovered from the strain of overwork. Then gradually build up its strength by suitable exercises.

To hasten the recovery of a strained muscle remember that Nature must do the actual work. Soaking the parts in warm water will tend to draw blood to that region. Gentle massage of adjacent muscles will promote lymph movement. Rest will allow time for disposal of fatigue products.

To prevent a second strain, strengthen the muscle and at the same time reduce the load either in actual poundage or in duration of time each day. If shoes are worn which permit the muscles of the foot to move about and get their normal exercise, the supporting structures of the foot should be expected to maintain sufficient strength to prevent trouble.

To suddenly discard tight shoes for properly designed shoes with ample room for foot movement, may put a sudden strain on supporting structures that are not trained to carry the load without assistance. If you have been wearing incorrect shoes, make a change gradually, at first part of each day, then a day at a time, then a week, until finally the foot is accustomed to do its own work as it should. Meanwhile wriggle the toes and flex the feet whenever the shoes are removed. Bathe the feet frequently not for the sake of excessive cleanliness but for the stimulation of blood and lymph movement which comes from bathing the skin.

Healthy vigorous feet are adaptable to changed conditions. An eminent specialist in foot conditions has for experimental purposes made a practice of wearing shoes which are not mates and in frequently changing one or both shoes from time to time. He has found that this practice enables him to wear nearly any style

of shoe, flexible or stiff, tight or loose with some degree of comfort. Of course properly designed and shaped shoes are the most comfortable, but the idea of having several pairs slightly different in last and changed rather frequently is worth considering. Such changing of shoes should make the foot more able to take care of itself under various conditions.

Bunions

Subsurface blisters in the region of a joint may form as the result of persistent irritating pressure. In the toes such formations are called bunions. The sac of serous fluid formed, offers a cushion against further pressure on the afflicted joint, and the mass of fluid makes a bulging of the skin which is the external sign of a bunion. The most common location of a bunion is at the juncture between the metatarsal and the first phalanx of the great toe. If the shoe bends the great toe toward the others, then the ends of the bones at this joint are presented to pressure. The prevention of bunions consists in wearing shoes that do not bend the bones of the foot out of their proper alignment.

A proper shoe does not necessarily mean a wide shoe, but it must have an inner line such that the great toe is not deflected by it. In this regard it must be remembered that when the weight of the body bears down on the foot, there is a tendency for the toes to spread. A shoe which allows no spreading of the toes robs them of this exercise.

Bone Bruises

Persons who are on their feet continuously sometimes develop a soreness of the under part of the heel, sometimes called a "bone bruise" or a "stone bruise." The

idea is prevalent that such soreness comes from bringing the weight down suddenly on the heel against a stone or other unyielding substance. Such conditions of soreness may come from strain of the ligaments and muscles whose attachment is at the heel, such stretching resulting in a stimulation of sensory nerves arising at the region of the heel.

Relief from heel soreness or other foot soreness, if the activating cause was stretched muscle attachments, is to be sought by resting the strained structures. The weight may be carried to the ball of the foot by exaggerating for a time the correct posture for walking.

To transfer the strain at the heel to the tendons of the muscles from the calf of the leg, take an erect position and flatten the lumbar curve by drawing in strongly the abdomen. *Tense the gluteal muscles* consciously and sway the weight forward onto the balls of the feet. There results a sense of tightness of the muscles in the back of the leg, and especially in the calf. These calf muscles end in tendons which run under the heel and attach to the sole of the foot well forward. Since they support the weight of the body, the fascia and ligaments arising from the heel and attaching under the toes are relieved.

In walking in the above position there is no need to think of how the foot strikes the ground; naturally the heel strikes the ground lightly, and the ball of the foot lands first or at nearly the same time as the heel. Whether one has sore heels or not, this is the best way to walk, and one who walks properly is not likely to develop sore heels.

Shoes

Much has been written about shoes. Many references to shoes have been made in this chapter and elsewhere

in this book. It seems that there is not much left unsaid. Shoes may be stiff or flexible, snug or loose, narrow or broad, or possessed of some degree of each of these qualities. Some shoes have a metal piece let into the sole to stiffen it with the avowed purpose of preserving thereby the arch. Such stiff soled shoes protect the feet more than do flexible shoes, but the latter allow the foot more exercise. A proper balance between protective function of the shoe and the strengthening effect of exercise must be sought. Those who have heavy weight to carry or long hours on the feet need especially strong foot structures. There must be generous blood and lymph supply to insure recovery of foot muscles from fatigue. At the same time a moderate degree of snugness about the instep and a reasonable degree of protection from the ground should be supplied by the sole. Artificial aids from shoes or arch supports should never be relied upon to do the work which properly trained foot muscles should accomplish.

The heel of the shoe should be of comfortable height and as broad as the bearing surface of the heel of the foot. Obviously the heel of the shoe should be under the os calcis since that is the point to be supported. Equally obviously, high tapering heels offer unreliable support. High heels allow the foot to tip sidewise and raise the heel so that the other structures of the foot are crowded forward into the toe of the shoe. To those who have grown up wearing heels, the muscles of the calf of the leg are not long enough to wear heelless shoes without further accommodation of these muscles to the new strains set up by discarding the lift of the heel.

All transitions in styles of footgear should be gradual. From tight to loose, stiff to flexible, high heels to

moderate heels, should be for most folk a reasonable tendency of change in footwear, but to try to effect radical changes suddenly is unwise. Remember that all biologic changes are extremely slow. Foot habits are changed slowly if discomfort and harm are to be avoided.

CHAPTER VIII

SLEEP

We do not understand what sleep is but we know what it accomplishes. We know that sleep is a building-up process, a restoration. While our senses are lulled, there is going on a steady flow of chemical processes in the body. The cells do not sleep. Accumulated fatigue products are being oxidized and removed. Relaxed muscles reduce to a minimum the production of additional fatigue products. But even in sleep muscular action is going on. The heart beats, the muscular movements of respiration continue. Chemical processes of oxidation are going on, and there is a general repair of worn tissue and building up of sources of energy. That is why we feel refreshed on awakening after a satisfying sleep. The activity of the skin is very great during sleep and the kidneys continue to function, straining out waste materials.

On falling asleep the skeletal muscles relax, respiration rate becomes slower and the depth of respiration is decreased. The actual amount of oxygen taken in per hour is less than during waking hours, but at the same time the amount of carbon dioxide given off is decreased in even greater proportion, so that the ratio of oxygen to carbon dioxide during sleep is greater than during waking.

The blood supply to the brain is less than during full consciousness and the heart beat is slower. Digestion is slowed down and peristalsis slows or stops. Growth of tissues continues, however. The period of life in which

the greatest proportion of the day is spent in sleep is the period of babyhood, the time of the most rapid growth. The food absorbed during the day is used to make tissue.

Hours of Sleep

The duration of sleep varies with the individual. Thomas Edison is known to have a habit of sleeping only three or four hours at a stretch. It is less well known that the celebrated inventor has the ability to rest frequently during the day for a few minutes at a time, and is said to avail himself of this ability to take "cat naps" frequently. Ty Cobb, equally well known to many Americans, is reported to require nine hours of sleep. A baby sleeps twenty hours a day. An adult usually sleeps about seven or eight hours. There is some difference, however, between the hours of sleep and the hours spent in bed.

After refreshing sleep one wakes naturally. When one wakes if not aroused unnaturally he has slept enough. It is time to get up. Lying in bed stagnates the mental and physical processes.

Nighttime is usually selected for sleep because everyone else does it. When there were not artificial lights available to all, nighttime was the logical time to sleep because our eyes are not suited to see in the dark. There is now no particular reason to use the nighttime for sleep except as a matter of convention. Those who work at night can rest as well in the day if the light is shut out from the sleeping room, and noise is avoided. There is this difference, however, between night and day sleep; in the summer time the nights are so much cooler than the day that rest and restoration are favored by sleep at the usual time.

It was a poet who said that, "One hour of sleep be-

fore midnight is worth two after." The sentiment is widely quoted, but the fact cannot be proved. To be sure if one prolongs his day of waking to several hours later than usual he will be so much more fatigued than usual. If, as is quite generally the case, one arises the next morning at the usual time the period of restoration has been shortened while the work to be accomplished by the body cells in sleep was increased. Of course, one is tired after such a condition.

Wakefulness

To those whose duties involve irregular hours and night work, the ability to go to sleep when opportunity presents is a valuable asset. One thing which interferes with going to sleep promptly is worry over wakefulness. The insomniac goes to bed wondering whether or not he can go to sleep. The mental activity incident to worry tends to keep the blood in the brain which is not a condition conducive to sleep. Such a person does not realize that the restoration processes of the body go on while we are relaxed muscularly whether senses are dulled or not. To be sure the rate of bodily chemistry is greater during wakeful resting than it is during the complete relaxation of sleep. One can learn, however, to relax the muscles though awake. Lying comfortably with relaxed muscles permits the processes of rejuvenation to make headway. Fatigue products are removed faster than they are accumulated. Next to sleeping, lying quietly is the best way to gain strength for the next job.

Position for Sleep

The body must be in a comfortable position if rest is to be attained. For some it is restful to lie flat on the back. For many this is not desirable. The weight of

the viscera pressing against the plexuses in the dorsal aspect of the body cavity may so stimulate the brain as to cause dreams. The uvula too may drop down and interfere with breathing and may cause snoring. Lying on one side or the other is usually more suitable and there is little to be said in favor of one side over the other. A popular belief is that lying on the right side relieves the heart because the blood can now flow down hill. In the case of blood circulation what goes down must come up. The circuit is a closed one. A straight position of the body is to be preferred to the curled attitude because of the cramping of organs caused by the latter position. Likewise a spring and mattress which will support the body without sagging prevent unfavorable curvature of the spine during sleep.

Indigestion as a cause of faulty sleep is possible but is largely overrated. Constipation may, however, be attended with gas accumulations which can exert enough pressure on nerves to keep one conscious of discomfort.

The Mind in Sleep

We are not entirely unconscious during sleep. The closed eyes keep out direct light rays but a bright light carried into a room where there are sleepers will cause some of them to awake. How did it do it? The sense of sight must have been working, it would seem. Every one knows that a loud noise will awaken one. How can we hear a noise unless the sense of hearing is functioning? The senses are lulled but not suspended. The technic of the policeman in waking the sleeper on a park bench is to rap him on the soles of his feet. This method is peculiarly effective since it is a fact that the parts of the body farthest from the brain are least

insulated from consciousness in sleep. To be awakened by a touch on the feet or the hands is less of a shock than by a touch on the head.

Another bit of evidence which indicates that the senses are not paralyzed in sleep is illustrated by the ability of six out of ten persons to awake at a given time upon which they may have decided before going to sleep. The power of "remembering" and sensing time is greater during sleep than during waking hours. How many persons can decide at nine o'clock in the morning to do a certain thing, meet an appointment for instance, say at three o'clock that afternoon and still make the appointment without consulting a time piece? And yet most persons can arise at a given time without an alarm clock.

Sleep is not coma nor is it anesthesia. It is a period of relaxation of the body faculties and of comparative muscular quiet. When this point is thoroughly realized, it becomes evident that any degree of rest of the body and mind short of sleep is in some degree beneficial in the same way that sleep is beneficial. When one can convince an insomniac that he will not necessarily suffer from lack of rest even if he can't close his eyes, that wakeful resting takes longer than sleeping rest, but is otherwise the same, you will have abolished his chief source of worry. It is worry over lack of sleep and not the actual lack that does the most harm.

For those who can regulate their occupation, regularity of sleeping hours is desirable. The habit of going to sleep at a given time is useful. One usually by experiment finds out how long he must stay in bed to recover from a given routine day's occupation, and having found the minimal time, he should see to it that that amount of time is spent in bed. If temporary in-

roads are made into the normal quota of sleeping hours, one good extra long sleep will make up for the loss.

Prevention of Insomnia

Certain types of sleeplessness may be attributed to causes which are preventable. An uncomfortable bed, a distended intestine, not enough coverings, too hot a room, all or any of these may interfere with sleep. The cause should be sought in one's surroundings or behavior and if possible remedied. See that no unnecessary stimuli reach the brain from eyes, ears, nose, teeth, stomach or bodily sensory nerves. A hot drink before retiring pulls the blood to the stomach and away from the brain. Remember that the digestive processes will slow down, however, and do not make the hot drink something that needs long digestive treatment like cocoa. Hot water or milk or bouillon is better. A hot water bottle at the feet is comforting and sensible.

CHAPTER IX

CLEANLINESS

A Clean Skin

There is being deposited on the skin constantly by the sweat an accumulation of material which upon evaporation leaves a layer of solids. In certain regions the deposits on the skin are oily. Dust and dirt from the outside mix with these deposits and the result is a skin which may or may not look dirty, but one which is more or less unable to exercise its full functions of excretion. In the course of a day these accumulations may amount to from five to ten grams of dry material.

To remove the accumulations on the skin, soap and water are the best agents. Soap acts as a solvent for grease. Too much soap will therefore render the skin dry. Likewise soap being made by the combination of an alkali with a fat, some soaps are imperfectly neutralized in their manufacture. Such soaps have an alkaline reaction and are extremely efficient in removing grease spots or oily stains from clothing. They are obviously too strong for ordinary use on the skin. Laundry soap is for cleaning clothing. It is best kept away from the body.

Bathing

Bathing too frequently with even a neutral soap will remove the oil from the epidermis more rapidly than Nature can restore it. Use soap only as often as is necessary to keep the skin clean. Frequent bathing without

soap will keep the skin well rinsed. Do not be afraid to use the tub even though you "don't need a bath."

Odors

There are two purposes served in bathing frequently. The primary purpose is to keep the skin free from accumulations so that it can perform its normal excretory function. The second purpose should be to keep down body odors. Personal beauty is incidental. Every body in its secretions emits an odor. The secretions through the skin in the scalp and especially in the axillae seem to be retained by the hair, and their odor may be very distinct and usually unpleasant to others. Like Halitosis (which has been made a part of the nation's store of long words) this odor from the body is not detectable to the possessor. It is generally offensive to others. (Bodily odors are especially strong and particularly pungent at or near the menstrual period.)

Anyone whose occupation brings him near other persons constantly should take care that bodily odors are kept down. Some individuals try to mask these odors with perfume. It is an open question in the minds of many which type of scent is worse. A strong odor of perfumery leads many a man to wonder if the user has to use so much.

Clean Smells

There is a difference between the odor of an unwashed body and that of a clean skin. The method of preventing the undesirable odors is to keep the skin in active condition and frequently rinsed off. This leads to a consideration of how often to bathe. For several reasons the whole body should be bathed once a day. This does not mean scrubbed with soap every day, for such

a procedure is too vigorous for most skins. Every day it should be thoroughly washed with water all over, soap being used in the regions where hair is thick and on the exposed hands and face as often as necessary.

The Morning Bath

Because of the bracing effect and the moral support which the bath in the morning gives, every one should take some sort of an all over bath before breakfast. The morning bath is, in the opinion of some, more valuable as a builder of self-respect than as a necessary cleansing process. However, when two birds can be killed with one stone it matters little which is hit first or harder. The morning bath does accomplish two functions.

It is known that warm and hot baths relax the muscles and bring the blood to the skin as the vasomotor mechanisms endeavor to cool off the body surrounded with heat. On the other hand the effect of cold water is to drive away the heat from the skin thus conserving to the body the heat which it otherwise would lose to the cold water. To soak a body in cold water will abstract body heat and result eventually in a chill unless muscular activity creates new body heat.

The Reaction from a Cold Bath

A dash of cold water, however, sends the blood to the viscera to be sure, but if the chill of the water is immediately removed and a towel applied vigorously, at once, there results a quick accumulation of heat in the muscles and the vasomotor mechanisms immediately send the blood rushing back to the skin to get rid of this threatened wave of heat. The toweling exercises the

muscles, moves about the tissues of the skin and underlying structures, promotes lymph movements and opens up the pores. The blood rushing back into the skin capillaries to get rid of this newly accumulated heat causes a glow which pleasantly stimulates the nerves which detect warmth and the whole body tingles pleasantly. This is the proper physiologic reaction which should follow a cold bath. It is induced by a sudden shock of cold water not too prolonged, followed by vigorous rubbing with a rough towel. It is aided by the mechanisms of the body which tend to keep the body heat equalized.

Body Temperature Regulation

In a healthy tissue there are nerve receptors which are sensitive to cold and others which are sensitive to heat. From these receptors messages go to the brain giving sensations recognized as coldness or warmth. Also messages are sent to an area of the brain which does not take care of sensation but instead governs the size of the blood capillaries. When cold messages reach this center, known as the vasomotor center, a reply is sent back to the region from which the cold messages were received and the blood vessels in that area are enlarged, allowing a larger proportion of the blood to flow through these particular capillaries. The blood carries heat with it from the warm parts of the body to the cold parts and so the regions which have been threatened with an unfavorably cold temperature are warmed. As the body temperature is restored the heat receptors of the region become stimulated and send their messages to the brain, one set resulting in the feeling of warmth and the other set of similar mes-

sages stimulating the vasomotor center to return messages which turn off the heat by constricting the blood vessels of that area. In this manner the body normally keeps an even temperature.

The amount of heat generated in the body is always in excess of the amount actually needed and the excess heat is usually radiated away from the body. A sudden cooling of the whole skin subtracts so much heat all at once that the rapidly circulating blood transmits this cooling effect to the whole organism. It is a general rule in physiology that when the whole body structure is threatened, the more vital parts are protected first. That is why the abstraction of heat from the whole body in the cold bath results in the diversion of the blood from the less important skin to the more essential viscera, while if only one finger be plunged in cold water it rapidly warms up. The water does not feel cold to the finger but it does to the skin when the whole body is cooled.

The prompt reaction to the removal of the cooling if aided by rubbing comes from the insistent calls for heat from the cold tissues in the skin. As soon as enough heat to take care of the internal organs has been generated, as it is in a few moments if there is prompt muscular exercise, the heat is turned to the skin and in proportion to the excess heat just generated it will come back with a rush or merely gradually.

The body can be trained to generate heat rapidly and to switch it rapidly from the skin to viscera or back again as the need arises. A body so trained will respond faithfully and automatically to any changes in temperature to which it may be subjected by drafts or other sudden cooling. Such a body withstands changes of temperature and maintains its own proper distribu-

tion of heat under widely varying conditions. The person with such a body does not suffer from cold.

The Cold Bath

The technic of the cold bath is subject to wide variations. The degree of coldness may vary with the individual. The normal body temperature is about 98 degrees Fahrenheit. The air we live in is ordinarily between 65 and 75—or at least it ought to be. Anything colder than that is cold to the body; anything between 75 and 98 is warmer than usual. Any temperature above 98 is hot. These facts apply to water of the bath. Water that is warmer than the air in which we normally live tends to supply more heat than the body is accustomed to, the heat loss from the body with its usual circulation, is diminished and the vasomotor mechanisms compensate by turning more blood to the skin at once where it can get rid of its heat. Any temperature of water that is cooler than the air in which the body is normally maintained abstracts more heat from the body than usual and the corresponding reaction to conserve heat is brought about.

The water may be applied to the skin with a sponge or cloth, or from a shower, or in a tub. So long as the contact is fairly well over the whole body at once and is not prolonged too greatly, it matters little except for convenience which method is employed. The shower is usually the most fun and the added stinging effect of the minute jets of water stimulates the tissues. If a reaction does not follow a vigorous rub down, the body has been cooled too much for its recuperative powers. A sluggish reaction will improve wonderfully from practice, however. If reaction is difficult to induce, start

with lukewarm water and towel vigorously to get the skin in good condition. Except in the case of defective heart action any body can be trained to react stimulatingly to the cold bath.

The Hot Tub Bath

To aid in relaxing tired muscles the hot tub is effective. Usually, however, what we refer to as a hot bath is really technically only warm, that is, some temperature less than 98°. Usually the feelings prevent the use of water that is unwisely hot. Have the water as warm as you like the feeling of it and it will usually be all right. Soaking occasionally in a warm bath is excellent for the skin. By pulling the blood to the surface the viscera are relieved from congestion. By the stimulation of the body to get rid of more heat than usual perspiration is stimulated and the bath water washes away the excretion.

The correct and efficient manner of taking the warm bath is to immerse the body if possible until the skin is well reddened, then lather the skin with a pleasant neutral soap (good soaps made from cocoanut and palm oils lather freely) and then get under water again and with a bath sponge remove the soap and dissolved secretions. The warm bath opens the pores and should be followed by a sponging or dash of cooler water to close them to their normal state. Avoid cold water unless you want to stimulate the whole body processes. A stimulating bath is not an aid to sleep. Its time is in the morning. A warm bath does aid in lulling the senses and is an excellent precursor to sleep. The time for the warm bath is obviously before retiring.

The increased activity of the body as a whole after a

cold bath is shown by the increase in oxygen consumption after a vigorous skin reaction. This oxygen consumption may be half as much again as is usual and the effect lasts for an hour or so, diminishing gradually.

The Healthy Skin

The appearance of the skin is an index to general bodily efficiency. A skin whose pores are clogged cannot be at its best efficiency and an efficiently functioning skin is necessary for a healthy body. No amount of paint and powder can duplicate the appearance of a natural glowing skin. Moreover the use of either tends to clog the pores and make conditions worse. Many a work of the Old Masters in art has been hidden under a daub of paint. The connoisseur removes the paint and enjoys the real thing below. To those who are conversant with the facts of hygiene the sight of a person whose skin is hidden under cosmetics suggests that there was something to hide just as the use of a strong perfume suggests an odor that the user has attempted to mask.

Hair

The condition of the hair is governed by the condition of the scalp in which the hair roots lie. Hair is living material. Its life depends upon nourishment of its follicles and the proper removal of waste therefrom. This nourishment and waste removal are accomplished by moving lymph and blood. Because the scalp is fitted over an unyielding bony support there is more likelihood of pressure upon the channels of blood and lymph circulation in the scalp with consequent inefficiency in their proper functions. The way to restore the circulation of the scalp is to exercise it. Not many

persons can exercise the muscular attachments of their scalp so as to wriggle the ears, but every one can move the scalp about more or less by rubbing it. The value of hair tonics is not in their ingredients, but in the rubbing of the scalp incident to their application. Rubbing without the hair tonic would be usually just as effective although some "tonics" may aid in cleansing the skin.

Care of the Scalp

The scalp must be kept clean if it is to exercise its proper functions of excretion of wastes and secretion of oily material. Washing the scalp too frequently with an alkaline soap tends to remove these oily secretions and make the hair dry. This effect is more marked in those who wash the scalp only when the hair is obviously in such unclean condition as to be noticeable. Hair that grows on a scalp which is kept well massaged and cleaned does not stay dry after a shampoo nor does it become greasy and stringy.

Brushing the hair is also a stimulation to the scalp and the hair follicles. The scalp can be made to glow by brushing the hair. A scalp which is thick and soft and freely movable over the skull will maintain a healthy substratum for the hair. It is not fat that is necessary but good circulation.

The Shampoo

In the shampoo, the attention should be paid to the scalp. Rub the soap lather well into the scalp and only incidentally into the hair. In the process of rinsing out the soap the hair will be freed from dust. It is important to dry the hair and undesirable to do this with a blast of air. The drying in a blast of air depends

upon supplying enough fresh air so that evaporation will remove the water. Evaporation always withdraws heat from the surface from which evaporation takes place. This means that the scalp is cooled. The effect is like that of too prolonged cold bathing. The skin becomes chilled and the blood is discouraged from returning. A scalp cooled and kept continually chilled for the time necessary to dry the hair will not have a good reaction and its health is thereby impaired. Rub the hair dry, fluff it in the sun or the heat of a radiator, or in the open air but not in a strong wind. While it is drying run the fingers through the hair frequently rubbing the scalp and stimulating its circulation. The head should be in a pleasant glow after the shampoo.

Bobbed Hair

What to think about bobbed hair is puzzling. The practice among women has of late years spread widely, and it obviously has hygienic aspects that merit attention. Hair originally served the purpose of protecting the head from the sun and the elements. Now man wears a hat out of doors, and bald headed men seem to be as well protected as their more thickly thatched brothers. It would seem that hair now has a decorative rather than a utilitarian function. It has been called woman's crowning glory. Allowed to grow long, the variations in style of hairdressing have become great. Men do not adorn themselves to please the eye of their fellow men, nor do women seem to value personal adornment primarily for the sake of their sisters. Feminine rivalry in personal appearance has a background that is biological. What the bearing of these facts upon the ultimate fate of the style of bobbed hair

may be it is hard to foresee. In any case the attitude of the public toward bobbed hair must be taken into account by the nurse and by other professional women with varied clientele.

Hygienically, short hair should be preferable to long hair because it is easier to clean the scalp through short hair. However, men have worn their hair clipped for ages and it is not certain that they are more careful of their scalps than are women. Style takes little thought of science or even of convenience, and it would be contrary to human experience to assume that the cause of bobbing hair was any hygienic consideration. Such considerations coupled with the experience of many women in the convenience of shorter locks may have an effect on its ultimate fate. Insofar as appearance goes, it must be a matter of opinion whether bobbed tresses are more becoming than masses of hair. One thing is certain, it is easier to cut hair short than it is to grow it long again.

Concerning baldness the cause is not known. Falling hair is often due to faulty nutrition of the scalp and can be remedied to some extent by attention to scalp hygiene.

The Nails

The care of the nails aside from conforming to prevailing custom in the trimming involves keeping the cuticle pushed well back from the nail. This should be done with a blunt instrument, preferably a finger stick. Its importance is in preventing the splitting of the skin as the nail grows forward. Hang nails which are really split cuticle offer a portal for infection by bacteria and may lead to blood poisoning or at least soreness and inflammation. The doctor and the nurse are under spe-

cial necessity of preventing the formation of any such possible portals of infection.

Ingrowing toe nails are encouraged by trimming the nail at the angle between the front margin and the sides. Toe nails should be trimmed straight across so that the edges will not be forced down and under as the foot pushes against the shoe.

Cleanliness and Personality

Cleanliness of body induces cleanliness of spirit. There is nothing so beautiful as a clean, well-kept body housing a clean well-kept personality. We commonly regard the two as inseparable.

Biologic Cleanliness

The biologist recognizes two kinds of cleanliness, one of which is called biologic cleanliness. This concept involves consideration of the bacterial causes of certain pathologic conditions. A drinking glass may look clean and yet harbor on its rim microorganisms invisible to the unaided eye which nevertheless may cause infection. On the other hand a smear of grease on the face may look unsightly and yet if it be free from dangerous microbes be biologically clean. The visible dirt is always cause for suspicion but it is the *invisible* dirt that is dangerous. Because things look clean is, of course, no criterion of their biologic cleanliness, a point which is appreciated by all workers in the fields of biology.

CHAPTER X

NUTRITION

Diet

The science of nutrition is concerned with the questions of what to eat and how much to eat. To answer these questions much experimentation has been carried out as a result of which there has been developed the art of dietetics.

To know what to eat involves some knowledge of the nature of various foodstuffs, their digestibility and their usefulness to the body. The purpose served by food is the supply of energy to the body for translation into work done by body cells and the supply of materials for the construction of new tissues in growth or in replacement of dead tissue.

The materials which supply energy have been discussed, carbohydrates, fats and proteins being the sources of energy. The materials needed for body building can be determined from a study of the chemical makeup of the body. These materials include: water, carbon, hydrogen, oxygen, nitrogen, phosphorus, sulphur, sodium, chlorine, calcium, potassium, iron, and other mineral substances.

The nonmineral constituents of the body are obtained from proteins, fats or carbohydrates. Building of protoplasm can occur only if nitrogen is available, and the only one of the three principal classes of foodstuffs which contains nitrogen is protein. Protein then is a prime requisite for growth and repair. For energy pur-

poses we can use carbohydrates, fat, or protein after its nitrogen has been split off. Excess protein nitrogen cannot be stored in the body but excess of any of the other food substances can be stored in the body as fat.

Vitamines

To build a house it is not sufficient to dump stones or bricks into a hole in the ground; they must be sorted out and welded together in proper relation each to the other. Likewise to feed the body it is not sufficient to supply food to eat. The food after digestion and absorption must be properly acted upon to have its molecules arranged in the necessary fashion. This ultimate utilization of food is brought about by chemical processes which do not properly take place without the presence of still other chemical aids whose effect we can measure even though we do not know what they are. The vitamins are these chemical aids to the final arrangement of the molecules of absorbed food substance. Feeding a young animal on sufficient protein for its weight and sufficient fuel for its physical activities does not result in healthy growth unless there be supplied also the necessary vitamins.

The knowledge concerning vitamins is limited largely to the observation of their growth effects and the gradually increasing experience which shows what foods contain them. So far there have been observed effects in nutrition which lead to the belief that there are at least four classes of vitamins. For lack of complete knowledge of their nature they have been designated by letters, A, B, C, and D.

Vitamine A is necessary for the increase in weight of a young animal. Children whose diet lacks this vita-

mine may be apparently well fed and healthy but they do not gain in weight. If the vitamine is present but in too infrequent doses or in amount which is insufficient, some gain in weight may be recorded but it will be subnormal.

Vitamine B is necessary for maintaining the weight already gained. It also protects against certain diseases known under the group name of dietary deficiency diseases. The disease of the tropics known as beri beri is prevented by vitamine B and the diseased condition known as polyneuritis in fowls is likewise controlled by this vitamine.

Vitamine C protects against scurvy, a disease of the bones.

Vitamine D apparently has an effect on the appetite and on the development of certain vital functions.

The first of this list of vitamines is associated with fats. Animal fats are better as sources of Vitamine A than are vegetable fats. Butter fat or cream is the common source of Vitamine A, and leafy vegetables, especially the young green leaves, are another rich source of this substance. It is not easily destroyed in cooking so that boiled cabbage or spinach, whole milk, butter, cheese, as well as egg yolk and a variety of foods supply it in the ordinary diet. Because of its association naturally with fats, it is referred to as "fat soluble" on the supposition that it is soluble in fat.

Vitamine B is not associated with fat, but with watery foods. It is called water soluble. It is rather easily destroyed by cooking, being especially nonresistant to alkali, such as baking soda, and rather nonresistant to heat. Vitamine B is found most richly in vegetables, seeds and nuts. It is present in milk, even in skim milk. Properly pasteurized milk retains some of its B vitamine,

Vitamine C, which is most abundant in the juice of citrus fruits and acid fruits like the orange or the tomato, is less easily destroyed by heat. Fruit juices for the administering of this vitamine should be served uncooked. There is some C vitamine in milk and vegetables.

Vitamine D, the latest of the family, has been recently described and moreover it has been isolated in crystalline form.

Minerals

Of the mineral salts that are important in body building, iron, calcium, and phosphorus are especially important. Iron is a constituent of the red blood corpuscles which are constantly breaking down and must be replaced. Calcium is a constituent of all the bones as well as the teeth, and in addition has a powerful effect in solution upon the heart action. For a person weighing 150 pounds the calcium requirement per day is .45 gram. The phosphorus requirement is nearly double this figure, as against the protein requirement of 45 grams, one hundred times the amount of calcium.

Children, during the period of body formation, need a wise excess of mineral elements. Up to the age of thirteen years the child should receive in some form the equivalent of a full quart of milk to take care of the daily calcium and phosphorus requirements. Part of this can be supplied in the form of vegetable or other foods, but in this regard it must be remembered that not all foods are useful. Cereal foods, grains, fats, meat, are all poor in calcium. Grain products do, however, contain considerable amount of phosphorus.

Prenatal Diet and Teeth

The importance of calcium in the diet of the expectant mother is especially great. She must have enough, not only for her own requirements, but also for the bones of the developing embryo. Of exceeding great importance for the quality of the teeth of the infant is the prenatal diet of its mother. Sound teeth can be laid down only if adequate calcium, phosphorus, and vitamins be supplied through the placenta. Lack of these mineral elements in infancy predisposes to rickets.

The Balanced Ration

The aforementioned considerations suggest that in selecting what to eat one should take into account the analytical data which show what various foodstuffs contain. Tables of such data form the chief reference of the dietician. They are available in the form of government publications and are included in texts on the science of nutrition. These diet tables show what proportion of a given food consists of protein, fat, carbohydrate, water, total minerals, and often calcium, phosphorus and iron. Other tables in the recent books which have been published on vitamins tabulate the known data concerning the distribution of the vitamins A, B, and C in various foodstuffs. Data about Vitamine D will doubtless appear eventually.

In the substitution of one food for another in the diet, a unit of measure must be adopted which will allow various foods to be compared on a common basis. The basis of comparison which is logical is the energy content. It is obvious that a head of lettuce weighing 8 ounces contains less food value than 8 ounces of cheese. The reason is shown by the diet tables which show that

lettuce is on an average 95 per cent water, which, of course, has no fuel value. Of the fuel part, a small fraction, 1.8 per cent of the whole, is protein, and less than 5 per cent carbohydrate. It has a trace of fat. Cheese, on the other hand, has a water content of only about 30 per cent, a protein content of 30 per cent and a fat content slightly higher.

Quantities of various foods, irrespective of the bulk or weight, which supply the same calorie value, are called isodynamic quantities. The potential energy of isodynamic quantities of food is essentially the same.

In whatever form the calories are supplied to the body, the total quantity of energy in this form required by an individual doing the same work from day to day is a nearly constant figure. For one engaged in the occupation of nursing it appears that about 20 to 22 calories per day must be supplied for each pound that the body weighs. For strenuous work more energy in the form of carbohydrate should be supplied, and when duties are sedentary, less total energy is used.

The rather common idea that protein, especially red meat, enables a person to do strenuous work is a partial misconception. The amount of protein required varies with the age and weight of the individual but not with the work done. The wear and tear of tissues that we speak of so glibly is an infinitesimal quantity in the amount of nitrogen involved. There is not much more wear and tear during muscular exercise than during rest. It is energy that is turned into work during muscle activity and what we require to supply this energy is calorie value rather than nitrogen. Carbohydrates and secondarily fat are more useful as the part of the diet which is to be burned as fuel for producing energy.

The theoretical amount of protein which is the least sufficient amount for the average adult is about 45 grams per day.

Kinds of Protein

In judging whether protein supplied in a diet is adequate for requirements there is another consideration besides the amount in calories which must always be taken into account. Different kinds of protein vary. We know that the muscle of the beef animal tastes differently from the muscle of the sheep or that of the pig. All contain large amounts of protein, but the proteins are not identical. White of egg is largely protein and water, but the protein in egg is manifestly different from the protein in meat.

Amino Acids

A protein may be likened to a structure built of blocks. With a pile of building blocks one can build at different times, using the same set, different structures. Perhaps a house will require all of the blocks, a bridge more of one kind and none of another, and so on. Nature seems to have pursued this course in building proteins. All proteins can be resolved into constituent parts or blocks. There are only twenty or so different kinds of blocks which have ever been discovered. They are all different but all are called amino acids. These same blocks are used to build body proteins, but human body protein (or protoplasm) can only be constructed when certain of these amino acids are present in sufficient amount.

In the process of digestion we take protein from milk or eggs, or meat, or from all three, and tear them all down in the stomach and intestine to their constituent amino acids. There will be available for absorption

some or most of the twenty odd kinds, but according to the diet there may be a great preponderance of one kind or another and a relative deficiency in still other kinds.

Adequate Proteins

One of these amino acids which is particularly essential for growth is called tryptophane, an amino acid furnished plentifully when milk is broken down by digestion. Without tryptophane we cannot build up protoplasm in our own bodies even though all the others be present in profusion. Gelatine is a protein but it lacks tryptophane. Gelatine, therefore, alone is an inadequate protein. Beans contain protein but the protein is inadequate in another regard, likewise corn, and many of the cereal or plant proteins. What one inadequate protein lacks another may supply, so that by knowing the amino acid content of proteins we may combine in the diet proteins which separately are inadequate but which taken in combination supplement each other's deficiencies. The quantitative protein requirement mentioned refers to an amount of protein which taken as a whole is adequate for our nutritional requirements.

Because of the inadequacy of many proteins and the uncertainty regarding how much of the amino acid content may be superfluous, it is customary to include in the daily ration a wise excess over the theoretical amount. Unless the protein in the diet is carefully worked out as to its amino acid content, a safe rule to follow is to double the theoretical amount of protein and make it 90 grams a day for a person in adult life weighing 150 pounds. If a large part of this protein be of animal origin, as in milk, or eggs, or meat, then the margin need not be so great, say about 75 grams.

Amount of Protein

In the diet of the baby, which is normally milk, the protein content amounts to not over 10 per cent of the total calories. Milk protein is adequate in that it contains a reasonable supply of all the essential amino acids. Cow's milk contains in its protein a distribution of amino acids suitable for building cow protoplasm and this is not exactly the correct distribution for building human protoplasm. Cow's milk can be utilized, however, by the human animal and the excess amino acids form urea.

Having determined the proportion of the diet which must be in the form of protein, the remainder can be made up of carbohydrate and fat in almost any proportions except that nutrition is not good if more than half the total calories be fat.

The Individual Requirements

To take a concrete example, a woman weighing 125 pounds, age 20, engaged in hospital work, will require about 22 calories of food per day per pound of body weight. This means that in some form or other in addition to the water which makes up a part of all food, there must be supplied 2750 calories per day. Not more than 10 per cent of these calories need be protein, and since one gram of protein furnishes 4 calories of energy, 70 grams of protein should suffice. If this be largely protein of animal origin as it is in the usual diet, she has an ample wise excess of protein and she may be sure that wear and tear and body building will be taken care of. The excess nitrogen in the protein which is not used will be split off and will be excreted as urea. Of fat not more than 1380 calories are permissible and since each gram of fat furnishes nine calories of energy,

this will be supplied in 154 grams of fat. Ordinary appetite does not tolerate such large proportion of fat as this, so that in the ordinary diet her fat will be less than this amount, a safe figure. It makes no particular difference whether the fat is very low. Whatever its value, the remainder of the calorie content must be made up with carbohydrate foods, starches, cereals, sugar and sweets. These are supplied in bread, potatoes, vegetables in general, and in some degree by nearly all foods except butter.

To enable the body to utilize these calories of energy there must be an adequate amount of foods containing vitamins. Milk, butter, eggs and vegetables are the sources of the vitamins. In the average varied diet of the adult there should be a large proportion of vegetables, fresh fruits, and salads to take care of this requirement.

There remains the mineral content to take care of. Vegetables can be selected which will at the same time supply carbohydrates, vitamins, and minerals. Milk supplies all of these.

The Adequate Diet

The adequate diet contains a supply of digestible foodstuffs of sufficient energy value to take care of the day's work, a quantity of adequate protein sufficient to take care of repair and new growth, a mineral content to maintain the body's requirements in this regard and vitamins of all kinds to insure the utilization of the food absorbed.

Excess Protein

Most diets include a quantity of protein over and above the maximum requirement. The chief objection to this excess of protein lies in the fact that amino acids

are food, not only for the animal organism, but also for bacteria which live in the intestines of all animals. When the intestine contains an excess of amino acids as the result of digesting proteins, many of them are attacked by these bacteria before the amino acids can be absorbed through the intestinal wall. The results of amino acid decomposition by bacteria are chemical substances which taken subsequently into the body act like fatigue substances or toxin. This self-poisoning or auto-intoxication is a very common occurrence in high protein eaters with reduced bodily efficiency.

A large proportion of vegetables in the diet is beneficial, for besides insuring a plentiful supply of carbohydrates, minerals and vitamins it supplies to the intestine undigested residues of plant fiber which act as bulk to stimulate peristalsis and overcome constipation. The bacteria can and do feed upon the excess of sugars derived from the digestion of carbohydrates but the end product of bacterial action on sugar is not harmful, in fact it aids in overcoming the harmful putrefaction of protein.

Weight

As regards the final criterion of the adequacy of the diet we turn to the results. The purpose of food is to supply the necessary energy and building material to meet the demand of the body. This energy taken in from food is like money in the bank. It is valuable only as it is expended. To some extent it can be kept on deposit against future needs, and like a savings account it cannot be overdrawn. The body cannot create energy. What is available may be used up but unless more is replaced, the functions of life must cease.

The balance of energy in the body fluctuates. At times one is "full of energy" and at other times fatigu-

ing work leaves one "spent." The purpose of regulating the amount of food in the daily ration is to maintain a wise balance of unexpended energy over and above the daily expenditure, without loading down the body unduly.

When the calorie intake is greater than the calorie output, the excess will tend to be stored as fat. If the calorie intake is less than the calories used in work, then the excess expenditure must be made up from the stored energy or fat. After the fat is used up, if the amount of work continues to be more than the energy intake, the body is gradually broken down to supply the extra fuel. Muscle tissue is broken down first after fat and the body begins to waste away.

This simple arithmetic of the calories indicates why we gain or lose weight. Addition of tissue means putting on weight. Removal of tissue means loss in weight. Another type of gain in weight comes from growth of bones and muscles during the period of childhood, or from increase of muscle tissue due to exercise in adult life. Loss of weight in wasting diseases comes from sacrifice of good body tissue, and is really a symptom of starvation. In health, gain or loss in weight may be controlled through the diet.

The weight of the body serves as the indicator of the degree of success attained in regulating the diet to bodily needs. Normal healthy individuals of the same age and height weigh approximately the same. An important point to remember, however, is that this equality of weight is not absolute, but only approximate. Bones of one person are larger and heavier in proportion to the rest of the body than in another. One person has more room on a broad skeleton for muscles. A slender person has a lighter musculature.

A departure in weight of more than 20 per cent from the average is, however, to be considered carefully. An adult who is more than 20 per cent heavier than the average for his age and height, unless structural differences explain the excess poundage, is probably too fat to be in the best of health. Fat persons are considered poor risks by the life insurance companies who make it their business to know about such things.

Underweight is more serious before age 30 than after that age. In young folks it indicates impaired health. It may be brought about by faulty or insufficient diet, faulty digestion or other physical defects, or by habits of living which unduly drain the vitality.

CHAPTER XI

THE ENDOCRINE GLANDS

There are numerous glandular structures in the body which secrete substances which diffuse into the blood stream and are carried about, leaving it at one or more points and affecting the various organs at which they arrive. The glands which have this type of structure are called cryptorhetic (meaning hidden flow) or endocrine (meaning inner weeping). The secretions of the endocrines are of great importance to the physiology of the body as a whole. They seem to be regulatory of the body processes.

Thyroid

The thyroid gland in the neck is one of the endocrine glands. Its secretions govern the speed of biochemical processes. Other effects are due to the thyroid secretion. In fact the secretions of the endocrines seem to have an effect on each other which is either antagonistic or reciprocal. When all are in proper proportion, there results a balance which aids in securing normal health. When one gland secretes undue amounts, there are results that are a departure from the normal.

Adrenals

The adrenal glands are endocrines. Their secretion of adrenalin in times of anger and fear has been mentioned and one result of the hypersecretion of adrenalin has been pointed out in its effect on digestion and circulation. These glands are subject to disordered func-

tion which is difficult to get at even for diagnostic purposes. Endocrinology is quite largely experimental at the present time.

Goiter

One outward symptom that comes from the malfunction of the thyroid is the occurrence of goiter. Goiter comes from an enlarged thyroid gland. It is an affliction endemic in certain parts of the world. The incidence of goiter increases in districts where there is lack of iodine in the water or food. Sea food contains traces of iodine, and goiter is not common along the sea coast or among those who include in their diet sea fish, lobsters, clams and scallops.

In the middle west of our country there are areas where goiter is quite common. One of our western cities is now adding to the drinking water minute traces of iodine, not enough to affect the taste, but enough, it is hoped, to protect the consumers against goiter. In Michigan, at the request of the State Department of Health, all the manufacturers of table salt have agreed to retain a trace of iodine in their product. Goiter is more likely to occur in women than in men.

Lack of function of this gland in childhood results in lack of development, a condition known as cretinism. This can be relieved by expert administration of dried thyroid gland prepared from sheep's thyroid.

Gonads

Various other endocrine glands have an effect upon body metabolism which is to some degree known. It is not generally realized, however, that the gonads, or sex glands, also have an endocrine secretion which affects general bodily vigor.

There is little that one can do personally about his endocrines, but it is wise to remember that they exist and to know how they bring about their effects. Dwarfs and giants owe their abnormal structures to endocrine secretions. Eye troubles may sometimes be aided by suitable expert endocrine therapy. Digestion is affected by endocrine derangement.

Insulin

It has long been known that there are in the pancreas certain glandular areas, the so-called Isles of Langerhans, which secrete an internal secretion. It is now known that the presence of this internal secretion is necessary if the body cells are to utilize sugar in the normal fashion, and that a diminution or failure in this secretion is present in diabetes. The secretion of the Isles of Langerhans of the pancreas is called Insulin. Its administration in failure of the natural secretion relieves temporarily the inability of the diabetic to use the sugar obtained from digestion.

CHAPTER XII

REPRODUCTION

The subject of reproduction of the species has too often been regarded with the wrong attitude. To the natural curiosity of the growing young man or woman parents and teachers have offered evasive answers. That time is past. It is the duty of the well informed to answer questions concerning the true nature of reproduction frankly and truthfully. It can be done in the same matter of fact way that the garage man gives instruction in the manner of running a car, and equally without offense to modesty.

The Physiology of Reproduction

The understanding of reproduction is an understanding of the physiologic processes involved. The physiology of the reproductive mechanisms affects the life of the possessor. The physiology of reproduction, therefore, is a subject which cannot be neglected by the student of hygiene.

Reproduction of the species in mankind involves the fusion of two specialized cells, one of female origin and one of male origin. The terms male and female were coined in the past to designate the qualities which cause these two kinds of cells to differ from each other.

Reproduction in Simple Forms

In the lower forms of life, reproduction takes place in a simple way. Among the bacteria, for instance, the unit of life is one cell. This single cell may be repro-

duced and two cells formed from one by the simple process of splitting in half. That is all that takes place in reproduction among the bacteria.

Some plants give off certain cells which after separation from the plant divide by splitting and form two cells. If the two new cells stick together and each in turn becomes two more, we then have four cells in a row or package. The four become eight, sixteen, thirty-two, etc. The single cell has reproduced and grown into a new plant like the old. There is no essential difference between reproduction and growth by cell multiplication in these instances.

A little higher in the scale of life are plant forms living in the water from which certain cells called spores are liberated, of which some are large and some small. In the lowest forms these spores can each individually divide and produce a new individual. In forms slightly higher they lose this power of spontaneous growth. Whether large or small they need an added stimulus to start the process of cell division which is fundamental in reproduction. This added stimulus is furnished by an intermingling of the cellular contents of two of these nondividing spores.

Conjugation

In the process of conjugation between spores, one comes in contact with the other. Very likely a large spore must conjugate with a small spore. The cell membranes touch. Osmosis and diffusion effect a transfer of material from one cell to the other, or perhaps the small cell is engulfed in the larger. At any rate the intermingling of the contents of the two cells results in the stimulation of one of them to divide into two, four, eight, sixteen, etc. The mass of subdivided cells stick together. A new individual is developed.

The spores which have lost their power of reproduction without this added stimulus of conjugation are called gametes. The larger ones are macrogametes or female cells, while the smaller ones are microgametes or male cells. A gamete is a spore whose power of self division is restrained until the stimulus of added protoplasm is received from another gamete.

Reproduction in Man

In the animals including man, the same preliminary to reproduction is necessary, namely the fusion of a male gamete and a female gamete. The organs of the reproductive system are designed to provide the necessary gametes and to assist their meeting. Since the female gamete, or ovum, is always very much larger than the male gamete, or sperm, it is the female gamete which persists after the fusion of the two, and eventually develops into the baby. Since the female gamete is selected for development we find that provision for protecting and nourishing the growing embryo is provided in the female anatomy only, the corresponding structures of the male having through evolution practically disappeared.

The function of the male in reproduction being to contribute the male gamete necessary for development of a new member of the species, the male reproductive organs have developed an intromittent organ through which the sperms may be deposited in the vagina of the female near where the gametes are to unite and undergo development.

Both male and female have corresponding structures wherein the respective gametes are produced. In the female the ovaries are the region of gamete production. From them usually one gamete is produced every

twenty-eight days. The events connected with this gamete production are the physiologic concomitants of the twenty-eight day cycle in the life of woman.

Ovulation

After the first ovum has ripened in one of the ovaries, it is given forth from the ovary into the body cavity from which it enters the fallopian tube of one side or the other and gradually is rolled down to the uterus and out through the external orifice of the vagina. A human egg is only one-fifth as large in diameter as the head of a pin. The minute hole in the ovary which has been left behind as the egg departed fills with a yellowish substance called lutein. The mass of lutein material is now called corpus luteum (yellow body). The corpus luteum is a powerful endocrine gland whose existence is only transitory but whose effects are very great on the physiology of the female.

Menstruation

The endocrine secretions from the corpus luteum have a specific stimulating effect on the tissues lining the uterus. These tissues are stimulated to swell, largely because of increased blood supply. The lining tissues which in the quiet state are firm and unyielding become soft and spongy. This effect is maintained for a week or ten days and then the corpus luteum subsides and disappears, with it disappearing the endocrine stimuli to the uterus. The uterine tissues now cannot keep up the accelerated rate of growth that has been forced upon them. They break down at the inner surface of the organ. The tissues, mucous secretions and excess blood are liberated and expelled in the menstrual flow. After menstruation the lining of the uterus heals

rapidly, the blood supply shrinks to the quiet stage, the tissues rest. When the next ovulation, or expelling of an egg cell from the ovary, takes place, twenty-eight days after the previous one, a new corpus luteum will be formed, and the cycle will be repeated. But what of the eggs, the female gametes, which are liberated one at a time at each recurrence of ovulation?

Pregnancy

The passage of the egg under ordinary conditions down the fallopian tube toward the uterus is slow. About one centimeter a day is the rate of travel. A week may be consumed in negotiating this journey. Meanwhile the uterus has been stimulated to prepare for its reception. The corpus luteum prepares the uterus while the egg is on its way. When the egg arrives at the uterus, the tissues are no longer hard and unyielding, but are soft and spongy. It would be easy for the ovum to sink into the soft bed so formed and remain there. In the event that the ovum has been met in the fallopian tube by a male gamete and fusion of the two has taken place, the fertilized egg or zygote as we now may call it, does stop and bury itself in the uterine tissues. There it remains and grows through the period of gestation or pregnancy, or so long as the uterine tissues are continued in their highly vascular spongy state.

The period of gestation is 280 days and during all this time the uterus must be continued in the spongy vascular state which was induced by the corpus luteum secretions. In the case of pregnancy, the corpus luteum does not shrink promptly and disappear as it does in the normal sexual cycle. It grows larger instead and may get to be as large as a marble. It persists for several

months until the embryo is nearly ready for delivery to the outside world. And while the corpus luteum is present there are no further ovulations. No more eggs are given off until the corpus luteum has been absorbed. This guards against one pregnancy being superimposed upon another.

The Corpus Luteum

The presence of a functioning corpus luteum whether it be the ten day existence in absence of fertilization, or whether it be the longer duration of pregnancy, has a physiologic effect on the female organism besides the effect on the uterine tissues. Among the effects which are attributable to the endocrine secretions of the corpus is a stimulation of the breasts which are likely to become firmer just before menstruation with increased vascularity of the nipples. Incident to the effect on the blood supply at this time are secondary effects upon the nervous system. New stimuli are sent to the brain from various regions of the body. These stimuli may be so persistent as to be annoying and cause mental uneasiness or depression, irritability, or other emotional states. Usually these mental and nervous symptoms disappear at once after the menstrual flow starts or after the system has become adjusted to the new conditions of pregnancy.

Nerve Reactions

Uneasiness during early pregnancy is to be expected in the primipara. An understanding of what is going on and an explanation for the new and strange sensations robs them of their terrors. The expectant mother should be fully informed concerning the physiology of her condition and told what to expect. The arrival of strange sensations then is to her confirmation that the

expected is happening normally instead of a source of fear because of ignorance. One naturally fears getting lost when traveling a strange road for the first time. If the route has been described, then the arrival at the various landmarks is reassuring.

Puberty

In the case of the girl entering upon puberty, it is unnecessary cruelty for her to experience the physiologic symptoms of her first corpus luteum without knowledge of what to expect and an explanation of its meaning. She is entitled to the pride of knowing that she has attained to the state of potential motherhood. One does not object to the payment which insures the acquirement of a valuable possession.

Wholesome Instruction

Upon approaching womanhood the girl should also be informed of the essential facts of reproduction. Nothing is gained by leaving unsatisfied her natural curiosity, concerning the subject to which her attention is drawn by her own physical changes. She should be informed that she will in her life produce a limited number of ova of which she has at the time of attaining puberty probably thirty thousand partly matured in her two ovaries. For perhaps twenty years she will expect one of these to be given off at periods approximating the regular twenty-eight day cycle unless it be interrupted by pregnancy. At the same time she may properly be told that in man from puberty onward there is a practically unlimited supply of corresponding male gametes available and that one drop of male semen may contain more gametes than the total number in her own ovaries. During the sexual life of the man and woman there is

a biologic attraction between the two which if aroused and carried to its normal fulfillment leads to bodily union and probable fertilization of an ovum by one spermatozoon.

Sex Instinct

The so-called sex instinct is a biologic fact which cannot be denied. The attraction between the sexes may be aroused by propinquity. It should be allowed full sway only under intelligent control in the marriage relation. Like the other instincts, it can be controlled before the emotion gains full sway over the physical response. To dally with this fiery emotion is to profane that which should be sacred, and it is physiologically as well as morally unsound. The way to control any instinct is to train the mind to switch possible stimuli to other channels of response. Just as one can learn to avoid the emotion of fear by learning to switch the stimuli of noises to some other channel in the mentality, so one can learn to switch the stimuli which might lead to the emotions concomitant with the reflex of physical union to other channels.

It has been said and probably truly that the dance with its embrace between members of opposite sex may lead to desire of a physical nature. It may, and too often doubtless does, stimulate the primitive animal emotions. But the dance need not be an unwholesome stimulus. If one has a healthy body, it is a pleasure to engage in physical activity calling for a certain amount of skill.

Mental Attitudes

The young woman of today with her new ways of speech and freedom from restraint is a healthy outgrowth of civilization, but she should be informed of the power of instinct and should be convinced that she is no

more free from primitive instincts than her forbears. She should be made to realize that unconventional behavior never commands respect from others. By it professional standing is lowered and self-respect is broken down. The consciousness that self-respect is lost entails a mental state in which happiness is almost impossible.

After all, it is one's thoughts that determine one's behavior in the ultimate analysis. The clean sound body means the chance for a clean sound mind. The healthy mind does not enjoy suggestive plays or literature, and when such are experienced, the reaction is a feeling of disgust. Too much has been written about sex. It is merely a name devised by some scientist long ago to describe a fundamental difference in certain plants and animals which produce different kinds of gametes for the purpose of perpetuating the species.

Hygiene

Besides education in the truths of life, the adolescent girl needs to know something of the hygienic measures which she should take to insure a healthy bodily condition of her special generative organs. These special measures are simple and resolve themselves to the maintenance of cleanliness. The folds of the labia offer foci for accumulation of excretions which if not removed emit a rather strong odor noticeable to others if not to herself. After the monthly flow has stopped, a cleansing douche is common sense. Warm water is in any case the reasonable cleansing agent for all.

Because of the physical strain through the nervous system at and just before menstruation, the body should at such times not be subjected to arduous physical strain. This is especially essential very early in sexual life and at the approach of its close.

The Climacteric

At an age between 35 and 45 in most women there will come the change in life when the endocrine secretions from the ovaries begin to fail. A resultant upsetting of balance between all the endocrine secretions may result and various physical symptoms appear. There may be uneasiness, hot flushes, stray aches and pains. These are fostered by worry because of ignorance of what is happening. The menstruation becomes irregular. A missed period may cause fright. At such times the woman needs to command her resources of self-discipline, regulate her physical and mental occupations rationally and be assured that she is entering upon the serene part of the voyage of life. The vague fears of the unknown are physiologically harmful. To be able to face what comes in life without fear, with as much information as is available, is necessary if the health is to be maintained.

The subject of heredity is omitted from this book because it is not, strictly speaking, a matter of personal hygiene. The happiness of each generation is, however, dependent partly upon the preceding generation. We are all influenced by inherited characteristics. To know these characteristics may help to understand and make allowance for hereditary limitations.

In close association with others, an appreciation of hereditary characteristics and limitations is valuable in determining lines of conduct designed to smooth the pathway of life.

CHAPTER XIII

ADAPTATION TO ENVIRONMENT

Personal hygiene does not primarily concern the environment, yet there are certain phases of the environment which may be controlled or to which the habits of living may be adapted with benefit to the health of the individual.

Ventilation

The matter of ventilation is such a factor of the environment. It is not always possible to control ventilation, but often much can be done if one knows what to do. The extreme effects of vitiated air are well known. What it is about so-called vitiated air which is responsible for these unpleasant effects may not be so readily understood.

In 1862 the suggestion was offered that under ordinary conditions neither oxygen lack nor carbon dioxide excess are responsible for the discomfort of "bad air." Recent experimental work has confirmed this tentative conclusion as being in accord with established facts. To quote from the report of the New York State Commission on Ventilation published in 1923, "Changes in oxygen and carbon dioxide content of rooms in everyday problems of ventilation are of no practical importance."

The oxygen in an ill-ventilated room may drop from the normal of 21 per cent to 20 per cent of the total volume of air. Leaky doors and windows usually prevent any further decrease. The oxygen of the air in

mines is often held to as low a figure as 17 per cent in order to reduce the danger of combustion, and yet no difficulty of breathing is experienced. On Pike's Peak the partial pressure of oxygen shows a content of the air in oxygen to be about 13 per cent. At this extreme low figure breathing is labored at first but one becomes accustomed to it. The reduction of oxygen then in ordinary rooms is negligible.

Carbon Dioxide

As to carbon dioxide content, the air in the lungs normally contains about 5 per cent carbon dioxide and the outside air .03 per cent. The air in an ill-ventilated room may increase to .5 per cent but ordinarily not higher. In breweries the air used to contain as high as 2 per cent carbon dioxide but aside from deepened **respiration** no effect was observable from this concentration. It appears therefore that the narrow variations of these two gases in ordinary poor ventilation is not significant.

Various attempts to demonstrate the presence of toxic substances in expired air have failed of corroboration.

Temperature

Temperature is a factor, however, which does affect comfort. Human habitation of a room tends to increase the temperature of the air. The bodies of men give off heat. More heat is given off from the body in a cold room than in a warm room. If the room temperature approaches that of the body, there will be little or no **transfer** of heat. Body temperature is an index of the balance between body heat production and heat loss. If this heat loss is too greatly diminished, the body temperature will rise.

Humidity

Another factor in air condition that varies with human occupancy of a room is the moisture content of the air. Water is held in the air as vapor. At a given temperature there is a certain amount of water vapor that can be held in the air. Any addition of water vapor means condensation of moisture. Air which is filled with its maximum content of water vapor is said to be saturated with humidity. The evaporation of perspiration from the body adds water vapor to the surrounding air. The more nearly the air approaches its saturation point, the less easily can water evaporate from the body into the air. In air which is saturated with humidity no perspiration can evaporate. It stays on the skin and collects in beads. Evaporation of perspiration means always a cooling of the skin. This method of cooling the body is interfered with as the humidity of the air approaches saturation.

Air which is cool and dry therefore is more comfortable than air which is warm or moist and if the air be both warm and moist the effect is to increase the discomfort of the body.

Favorable Air Conditions

At a temperature of 68° F. a relative humidity of 50 per cent of saturation offers the most favorable condition of regulation of body temperature by transfer of heat through radiation and evaporation of perspiration. The metabolism of the body goes on regularly and heat is produced. When the temperature or humidity is higher than these figures, the loss of heat from the body is less rapid, and perspiration is increased.

In air at 68° and 80 per cent relative humidity the inclination to physical work is less than under favorable

conditions. The fatigued body is affected more unfavorably by high temperature and humidity than is the unfatigued body.

Air in motion, varying in both temperature and rate of movement, is stimulating to the skin and enhances the sense of well-being. Its beneficial effects on metabolism are far reaching. This is why one prefers to be out of doors, and is the reason for sleeping always with the windows open.

Mental Work and Ventilation

Mental work can be accomplished under stimulus in ill ventilation as well as in proper ventilation if the bodily discomforts do not detract the attention. Hot sticky evenings can be better employed in mental occupations than in physical recreation. The best thing to do about ill ventilation when it cannot be helped is to so occupy the mind while resting the body, that the discomfort will be forgotten.

The effect of heat and moisture on the respiratory tract has been investigated. In passing from a normal or cold room to a hot room, there is an increase in size and redness of the nasal mucosa. There is a similar effect on passing from a dry to a highly humid atmosphere.

Drafts

When the face is exposed to cold and drafts, there is a lessening of the nasal mucosa blood supply, but these membranes are distended and moist, offering favorable conditions for bacterial attack. The mucosa of individuals who are constantly subjected to excessive heat or humidity fail to react normally to cold air.

It appears, therefore, that there are certain general

conclusions that may be drawn concerning desirable conditions of ventilation. A temperature of from 65 to 70 degrees, preferably nearer the lower limit, is most favorable for body temperature regulation. A relative humidity of 50 per cent or less is desirable at the same time.

An increase of temperature from 68° to 75° causes perhaps 15 per cent loss in efficiency in physical activity. An increase to 86° with raising of relative humidity may reduce efficiency 25 per cent.

Sudden changes from high temperature to low or from low to high are usually undesirable, but the slightly changing temperature and rate of movement of outdoor air is stimulating to the skin, and explains why partial direct ventilation is more desirable than a completely mechanical system.

Odors in vitiated air are displeasing to the senses but have little physiologic effect, if any.

Clothing

When the ventilation cannot be controlled, we must adapt the body to conditions as they are found. Manifestly there is no control over outside temperature. Our adaptation to outside temperature must be through the medium of clothing and the regulation of muscular exercise. The purpose of clothing is to aid in maintaining bodily temperature as well as protection and adornment. The value of clothing depends upon its heat conducting quality. This quality is due not so much to the fibers of the cloth as to the nature of the spaces between fibers. Dry air is the best nonconductor of heat, therefore a garment of loosely woven cloth containing dry air in its pores will be a warm garment. Clothing made from cloth which is composed of hard

fibers which allow the air to circulate between the fibers will be cool. This is why woollen goods are worn in winter and cotton in summer.

The capacity of various goods for absorbing body perspiration varies. Wool has the greatest absorption coefficient, silk next, then linen and least of all cotton. Since clothing which takes up moisture transfers heat readily, wool next to the skin is usually not desirable. It should be in the outside garment if worn for warmth. The temperature while at rest indoors determines the nature and weight of underclothing that is best, while the outer garments are selected for the outside temperature.

In summer one turns naturally to thin light clothing. Coarse weave hard fiber materials are most comfortable. White goods look white because they reflect the rays from the sun and black goods appear black because they absorb these rays. The sun's rays consist of light and heat rays both and white or light colored goods are cooler to the wearer than dark colored goods of similar texture.

Bed clothing should be light in weight and filled with air spaces between the fibers if warmth is desired. Woollen blankets are for this reason warmer than cotton of the same weight. For the same reason puffs are warmest of all bed clothing. Two coverings are warmer than one because of the spaces between which are filled with air.

Communicable Diseases

Another factor of our environment with which we must reckon is the presence about us of persons who are victims of communicable diseases.

Communicable diseases are caused by the communication from a sick person to another individual of certain

specific living organisms or viruses which are able under some conditions to grow in the body of the victim and cause pathologic conditions. They are in general the so-called germ diseases. Because the virus of many communicable diseases is of bacterial nature, we have as a people come to link the terms bacteria and disease. This should not be so. Bacteria are necessary in nature for continued life of all forms. Bacteria at the surface of the earth feed upon and convert dead plants and animals into substances which can again be utilized by plants and most of the bacteria are beneficial rather than harmful. It is the minority which have by their activities in mankind placed the stigma upon the whole group, just as a small group of criminally inclined men can blacken the reputation of a community.

The intestine of all animals contains always from soon after birth until death a flourishing flora of bacteria. Under proper conditions these seem to do no harm. Bacteria are generally present on vegetables and are taken in on uncooked food, but ordinarily they do no harm. Everything that is exposed to dust and to handling becomes laden more or less with bacteria, but we do not sicken when we utilize such objects. It is only when bacteria of definite types, limited in the number of varieties, gain access to the body tissues and establish themselves there that we come down with a contagious disease.

Classification of Communicable Diseases

The communicable diseases may be classified in a number of ways. One classification is according to the part of the body affected. Thus we have a group of so-called respiratory diseases including whooping cough, diphtheria, pulmonary tuberculosis, common colds, and

pneumonia. Among the intestinal diseases are typhoid fever, cholera, and dysentery, all of which are caused by the encroachments of microorganisms upon the lining of the intestine. When an infection gains entrance to the blood stream we say that the disease belongs to the circulatory group, and as examples of communicable diseases of this type there are malaria, yellow fever, and septicemia or blood poisoning.

Another classification of communicable diseases takes into account the paths of infection, and groups the diseases as being spread by droplet infection (from mouth or nose in sneezing, coughing and vigorous conversation); insect borne diseases in which the cause is carried from sick to well by intermediary insects; contact diseases in which the cause travels from sick to well rather directly through personal contact or close association; and last the diseases which are spread by fomites, a name given to any lifeless object which has transferred to it from a sick person the germs of disease, and is able in turn to transfer these germs to a well person who handles the object. This rather cumbersome idea is illustrated by the act of the mistakenly generous child with a head cold and lollipop. The child with a cold has the germs which caused that cold in all probability in its mouth secretions. Anything going into the mouth becomes contaminated in all likelihood with those same germs. If the contaminated object is passed into the mouth of a healthy person without sufficient intervening time for the germs on the fomite to die or be removed, the fomite serves to transfer the virus of the disease, and the lollipop shared with the playmate transmits to that playmate the cold of the owner.

Natural Defenses

A knowledge of the cause of a communicable disease, how it leaves the sick body, and how it enters the well person is desirable if infection is to be avoided.

The mere transfer of disease germs to a healthy body does not mean necessarily that illness will follow. The body in health has strong defenses against infection. Its secretions are generally germicidal. In the unbroken skin we have an effective barrier and to some germs the healthy mucous membrane is quite resistant.

These various factors of bodily resistance to the invasion of pathogenic microbes we call collectively the power of natural immunity. In this case a better term would have been resistance rather than immunity because there are varying degrees of resistance, and the word "immunity" suggests no comparative degree. However the latter term is in common parlance of the practitioner and is retained here for that reason.

The body in health and uninjured can to a great degree take care of itself as regards germ diseases. However it is known that a sound body is not proof against such infections as smallpox. Moreover if the dose of infective agent be sufficiently great in amount or in strength, the body resistance will be overcome.

Any lowering of vitality either localized or general, weakens our resistance to the potential danger from germ diseases. Malnutrition, excessive fatigue (more often induced by excessive indulgence in physical play than in work), congestion, lack of cleanliness, any or all of these things lower the natural defenses of the body.

Specific Immunity

Specific immunity against certain diseases may be acquired. It is usually conferred by the first recovery

from certain diseases. It may also be conferred by injecting killed bacteria of the proper kind into the blood stream of the person who is to be immunized. Instruction in the nature and value of antityphoid prophylaxis, toxin-antitoxin treatment, and other measures of active immunization is a part of the expected training of the nurse. These matters should be under the care of the physician. They do not form a part of the subject matter of this text.

INDEX

A

Absorption, 29
 Adequate diet, 160
 Adequate proteins, 158
 Adrenal glands, 164
 Adrenalin, 78
 Alcohol, 91
 Alimentary tract, 58
 Ailments, fostered by attention, 80
 Air, 177
 favorable conditions, 179
 humidity, 179
 movement, 180
 temperature, 179
 vitiated, 177
 Amino acids, 157
 Appearance, 117
 Arches, 125
 Awakening, 21

B

Bacteria, 58, 182
 Balanced ration, 155
 Bath, cold, 141, 144
 warm, 145
 Bathing, 139, 141
 Bed clothing, 182
 Biologic cleanliness, 150
 Blood, 95
 food and, 96
 wastes and, 96
 Bobbed hair, 148
 Body mechanics, 113, 119
 odors, 140
 temperature, 142
 Bone bruises, 129
 Bowel congestion, 103
 habits, 70
 normal action, 71
 Bunions, 129

C

Caffeine, 90
 Calories, 39
 Caloric value of foodstuffs, 40
 Carbohydrates, 28
 cleavage of, 36
 Carbon dioxide, 178
 Caries, dental, 56
 Cathartics, 69, 72
 Causes of health, 19
 Cells, body, 98
 Cheerfulness, 80, 82, 93
 Cleanliness, 139
 and personality, 150
 biologic, 150
 Clothing, 181
 bed, 182
 Coffee, 90
 Cold bath, 141, 144
 Communicable diseases, 182
 Confidence, 92
 Congestion, 103, 104
 Conjugation, 168
 Constipation, 68
 Corpus luteum, 170, 172

D

Decay of teeth, 46
 Dental caries, 56
 floss, 52
 inspection, 50
 Dentine, 48
 Diabetes, 166
 Diet, 151
 adequate, 160
 and weight, 161
 high protein, 43
 individual requirements, 159
 protein in, 159
 Diffusion, 98
 Digestion, 26
 gastric, 34
 intestinal, 35, 37, 67
 salivary, 36, 45, 59, 63

Diseases, communicable, 182
 Drafts, 180
 Drugs, habit-forming, 91

E

Eating, 45, 64, 65
 Effectors, 75
 Efficient living, 21
 Emotions, 78
 Endocrines, 164
 Energetics, 27
 Energy, 27
 Exercise and circulation, 103
 and lymph, 101
 and respiration, 105
 general benefits, 105
 types, 106

F

Fads, 21
 Fatigue, 109
 recovery from, 112
 substances, 110
 Fats, 29, 37
 Flavors in foods, 59, 62
 Fletcherism, 61
 Focal infections, 55
 Food, 27
 and blood, 96
 choice of, 64
 for preventing constipation, 69
 Foot, arches, 125
 distortions, remedies, 127
 structure, 121
 troubles, 124

G

Game of life, 23
 Gingival tissues, 55
 Glands, endocrine, 164
 Goiter, 165
 Gonads, 165

H

Habits, eating, 65
 formation of, 79
 Hair, 146
 bobbed, 148

Health fads, 21
 Healthy skin, 146
 Hobbies, 83
 Hot bath, 145
 Humidity, 179
 Hygiene applied, 25

I

Immunity, 185
 Insomnia, 135
 prevention of, 138
 Instinct, 85
 control of, 86
 Insulin, 166
 Intestinal digestion, 67
 Iodine and goiter, 165

L

Laxatives, 69
 Lymph, 95, 100
 and exercise, 102
 and respiration, 101

M

Membranes, 33
 Menstruation, 170
 Mental hygiene, 88, 89
 Mental state, and adrenalin, 78
 and health, 80, 82
 and sleep, 84, 136
 at mealtimes, 66
 influence of on peristalsis, 68
 Minerals in diet, 154
 Molars, sixth year, 46
 Mouth, hygiene, 45
 watering of, 59, 60
 Muscles, and lymph, 95, 102
 and waste materials, 96
 exercise of, 94
 fatigue of, 109
 paralysis of, 77
 trunk, 115

N

Narcotics, 90
 Nails, care of, 149
 Nerves, arrangement and function of, 73

- Nerves—Cont'd.
 effect of stimulants and
 narcotics on, 90
 care of, 89
 living cells, 77
 Nervous system, 73
 and mentality, 78
 automatic, 75
 reactions of in pregnancy,
 172
 sympathetic, 75
 Nutrition, 151
- O
- Odors, body, 140
 Optimism, 80
 Oral cleansing, 53
 Osmosis, 31
 Ovulation, 170
- P
- Peristalsis, 68
 Permeability of membranes, 32
 Personality, 91, 150
 Posture, 107, 108
 effect on digestion, 69
 Pregnancy, 171
 Prenatal diet, 155
 Proteins, 29
 adequate, 158
 amount, 159
 excess, 43, 160
 kinds, 157
 splitting, 34
 Psychic secretion, 59
 Puberty, 173
 Pulp, in teeth, decay of, 56
 Pyorrhea, 55
- R
- Reaction from bath, 141, 145
 Receptors, intestinal, 76
 Reproduction, 167
 in man, 169
 Respiration, and exercise, 105
 and lymph, 101
- S
- Sacroiliac strain, 118
 Saliva, 58, 59
 Salivary digestion, 36, 45, 59, 63
 Salt and water for teeth, 53
 Scalp, 147
 Secretion, psychic, 59
 Sensory stimuli, 74
 Sex, hygiene, 173, 175
 instinct, 174
 Shampoo, 147
 Shoes, 130
 Sitting position, 108
 Sixth year molars, 46
 Sleep, 133
 hours of, 134
 position for, 135
 time for, 134
 the mind in, 136
 Spinal curves, 117
 Standing position, 107, 114
 Stasis, intestinal, 69
 Stimulants, 90
 "Stomach in," 106
 Stooping, 116
- T
- Tartar, 50
 Tasting of foods, 62, 63
 Tea, 90
 Teeth, 45
 prenatal diet and, 155
 Temperature, of air, 178
 of bath, 141, 145
 of body, 142
 Tobacco, 91
 Tooth brush, 54
 Tooth pastes and powders, 53
- W
- Wakefulness, 135
 Water drinking, 64, 68
 Watering of mouth, 59, 60
 Wastes, 40, 96
 Weight, 161
 Work, 26
 Worry, 74, 81
- V
- Value of health, 25
 Ventilation, 177
 and mental work, 180
 Vitamines, 152

613.02

B94

Bunker, J. W. M. & Turner, C. E.

Personal hygiene for

Nurses

1924

M. I. T. LIBRARY 142565

This book is due on the last date
stamped below.

NOV 27 1926

Subject to fine
if kept beyond date due

DEC 11 1926

JAN 2 1934

DEC 17 1926

NOV 30 1926

DEC 26 1926

JUN 27 1934

-1 NOV '27

JAN 20 1929

NOV 21 1934

-1 NOV '27

OCT 28 1929

NOV 20 1929

DEC 5 1927

JAN 2 - 1930

DEC 30 1927

JUL 31 1930

APR 28 1928

DEC 13 1930

SEP 28 1928

OCT 20 1928

DEC 14 1931

FEB

1 1932



3 9080 02557 0943

MASSACHUSETTS

INSTITUTE OF TECHNOLOGY

RULE ADOPTED BY THE LIBRARY COMMITTEE, MAY 17, 1910

If any book, the property of the Institute, shall be lost or seriously injured, as by any marks or writing made therein, the person to whom it stands charged shall replace it by a new copy, or by a new set if it forms a part of a set.

Form L53-5,000-19 Je '24

142565

MASSACHUSETTS INSTITUTE
OF TECHNOLOGY

LIBRARY

SIGN THIS CARD AND LEAVE IT
in the tray upon the desk.

NO BOOK may be taken from the
room UNTIL it has been REGISTERED
in this manner.

RETURN this book to the DESK.

FORM L44-5000-19 Je '24

